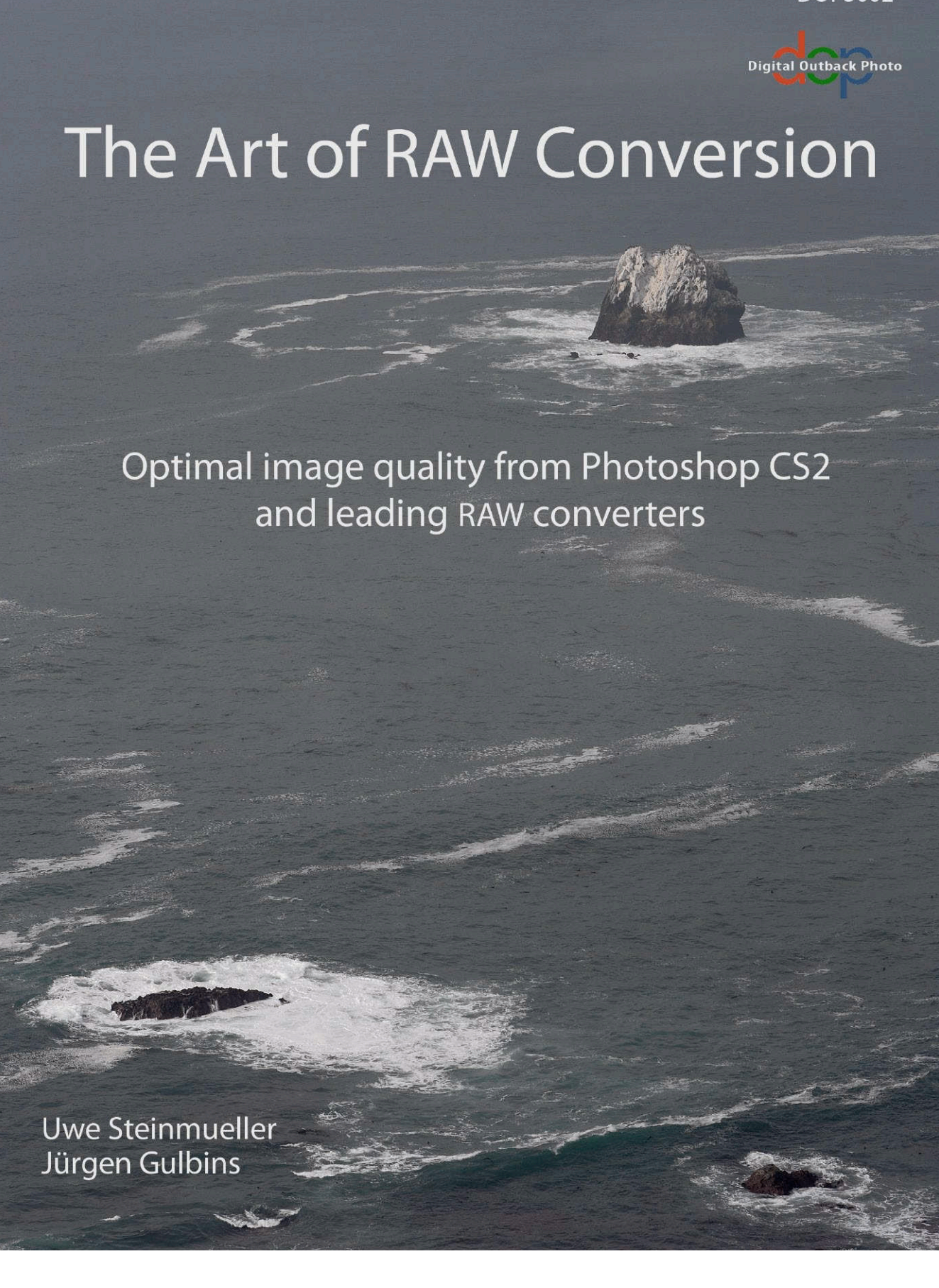
Digital Outback Photo
The Art of RAW Conversion
Optimal image quality from Photoshop CS2
and leading RAW converters
Uwe Steinmueller
Jürgen Gulbins

The Art of RAW Conversion

Optimal image quality from Photoshop CS2 and leading RAW converters.
Uwe Steinmuller, Jürgen Gulbins

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Preface

Literally dozens of books on digital photography are currently being published. Both authors Uwe Steinmueller and Jürgen Gulbins (until now only available in German) have contributed to this growing list. These books largely cover photographing aspects or image processing. An amazing list of hundreds of books exist on Photoshop. This book, however, focuses on an important step connecting shooting and image processing (and possible manipulation). It deals with the conversion of images shot using RAW format into images in a standardized image format, such as TIFF or JPEG. In our experience, shooting photographs using RAW format is strongly recommended. Doing so allows getting the highest quality from your camera and its images. It lets you decide on many image settings apart from the moment you took your photo and reduces the pressure and haste possibly existing as you took the picture. For many camera settings, RAW processing lets you reconsider and even revise settings made during shooting. This ability need not encourage sloppy photography, yet it gives you substantially more control of your pictures.

In this book, we mainly restrict our close scrutiny to the process of RAW conversion: What you should consider when shooting RAW, how to prepare files for conversion and how to set up an efficient conversion workflow as part of your total image workflow.

We will not go deeply into image processing and image manipulation in Photoshop, but we will discuss image enhancement either done in the camera, in the RAW converter or perhaps later in Photoshop.

The king of all image editors is Photoshop. It may not be the best solution for all image operations, but it provides an overall high level of functionality, an excellent integration of those various functions and definitely is the trendsetter for these kinds of applications. We believe these qualities justify its hefty price. Adobe Camera Raw, an excellent RAW converter, is provided as part of Photoshop CS. Of all RAW converters Camera Raw supports one of the broadest range of RAW formats, and is updated regularly in order to support newly released RAW camera formats. For this rea-

son, we delve deeper into details of Adobe Camera Raw than we do other RAW converters. Be aware that there are a number of RAW converters available, and some of them are quite good concerning resulting image quality and workflow integration. It may well be worth evaluating other RAW converters, as well and even using several for different situations and workflows. We focus on those we judge the best and most often used.

This book is not intended as a substitute for the program manual. Some programs would very likely be worth a book of their own. Instead, you will receive a thoughtful overview plus hints and recommendations allowing you to set up your own RAW workflow and adapting it to your personal preferences and kinds of work. We are focusing on getting the best possible images from the RAW files your camera produces.

The workflow we present is based on practical work with thousands of real-world RAW photographs.

This book is quite technical and deals with many aspects of various programs and techniques. Don't become confused: The goal is taking good photographs. Don't get lost in technique, spending time fiddling with programs and settings.

You can be more productive shooting good photographs, being creative, looking for appropriate light, finding the right angle of view and optimal settings. What we hope to show you in this book is making the most of the creative work done previously with your digital camera.

Acknowledgments

Thanks to our many influencers and friends, but especially to:
Bill Atkinson, Paul Caldwell, Jim Collum, Charles Cramer,
Antonio Dias, Katrin Eismann, Jack Flesher, Mac Holbert,
Michael Jonsson (creator of RawShooter),
Thomas Knoll (original creator of Photoshop and Camera Raw),
Phil Lindsay, Daniel Stephens, and Ben Willmore.

Last but not least we want to thank Bill Horton for correcting our somewhat german English.

Uwe Steinmueller, San Jose (California) June 2005
Jürgen Gulbins, Keltern (Germany)

Chapter 1

Introduction

Camera: Canon 10D

1.1 Introduction to RAW files or digital negatives

What is the *digital photography workflow*? All you want is to take a picture and get a great output. Yet, this process should be:

- Fast
- At reasonable cost
- Getting optimal quality

Digital workflow includes everything from the moment you take a picture until you print and archive it. Unfortunately there is no silver bullet to guarantee success in all of these areas. This book will not presume to sell you this illusion. What we can do is present a proven workflow that enables you to:

- Improve your output quality
- Save you time by avoiding costly personal exploration

This book tries to be as simple as possible but not simpler. The goal is not to become the great master in Photoshop or other tools. We hope to teach you how to use all necessary imaging tools in a manner allowing you to create the images you want without undue trial and error.

1.2 How to use this book, how this book is organized

In this book we attempt to cover the Microsoft Windows platform, as well as, Macintosh (Mac OS X). The two use some different keyboard shortcuts. In most cases, substitute the Windows Ctrl key with the Mac ⌘ key (labeled and also known as *command key*) and the Windows Alt key with the Mac ⌥ key (called *option key*). When you read a key sequence like Ctrl/⌘-S it means you have to press Ctrl and S together in Windows and ⌘ together with S with Mac OS. ⇧ is the symbol used for the shift key.

Some of our photographic artwork is included to remind you that it is all about good pictures and not just technique. We prefer a great vision not perfectly executed, over a technically perfect ,boring picture. We trust you understand what we mean by this. In the end, your eyes are the most important tools to succeed in photography.

Keep your vision fresh!

1.3 Using PCs and Macs

We – Bettina and Uwe Steinmueller – work on PCs most of the time. Fortunately, Photoshop CS is pretty much the same for PCs and Macs (apart from some different keystrokes). This makes all Photoshop content valid on both platforms. Author Jürgen Gulbins uses a Macintosh as his primary platform. So, both systems are used in this book – without any serious incompatibilities or problems. A few tools we use are available only for the PC. In most cases, you can locate an equivalent tool for the Mac platform. As for the computer configuration, dealt with in the following section, the requirements are very much the same for a Windows PC or a Macintosh.

1.4 Computer configuration

Image processing is often quite demanding of your computer hardware. Some guidelines (valid for both Macs and PCs):

- 1 GB of memory is a good start (0.5 GB is the bare minimum, (While 1 GB is good, more is even better)
- Don't settle for a low-quality monitor. 1280 × 1024 is an acceptable resolution. Again, more is better (we use 1600 × 1200). High resolution should accompany a sufficiently large screen (19" or more is suggested)
- Having USB 2.0 and Firewire ports are a plus
- Dual Processors is a plus, utilized by Photoshop
- Disks space:
  - 1 × 80 GB or more for your operating system
  - 1 × 80 GB or more for working files
  - 2 × 120 GB or more for archiving
    (external USB 2.0 or Firewire drives are fine)
- External Compact Flash (CF) card reader with USB 2.0 or Firewire connection (USB 1.0 is considerably slower)
- DVD reader/writer (external Firewire is fine)
- Device for monitor profiling (see chapter 2.3)

In all cases, "more" is better. The result is faster operation, a more comfortable workflow and a more pleasant working environment. Doing color work, the importance of a good large monitor should not be underestimated. When, in previous years, CRT monitors had advantages over LCDs – especially concerning color confidence – this is no longer true. There are many very good LCD monitors on the market. You have to spend up to 3 times the amount of money to get an LCD with the same size and quality of a CRT. For color work, laptop screens are usually not as effective as stand-alone monitors. In most cases, their contrast is lower and in almost all cases their color quality is of lower quality.

1.5 What are RAW files?

In many ways, using a film camera and a digital camera is identical. This section concentrates on the things that are different and must be known to start the digital workflow with the best possible photographic material. As always, the optimal framing and exposure lead to better images. Otherwise, 'garbage in means garbage out.' This does not mean, however, that you cannot get great pictures from less than optimal shots. But be prepared. This requires much more work in the digital darkroom

The most common image format today with digital cameras is JPEG (*Joint Photographic Experts Group*). The obvious limitation of JPEGs are that they are most often used for their excellent, but lossy compression format (there are also lossless JPEGs rarely used in cameras). Even at low compression rates, an image degrades slightly. A more important point is the fact that an image undergoes heavy color/exposure/noise/sharpening processing within the camera. These adjustments reduce the ability to make further post-processing corrections. JPEG compression works best for images with no need of further substantial post-processing (his is rare if you are demanding) or under circumstances where such post-processing is prohibited.

Many photographers try to get the best possible quality out of their cameras using the TIFF selection, or if supported by the camera, a vendor-specific RAW file format. As you will see, RAW file formats allow for the greatest post-processing flexibility.

If you decide to continue using only JPEGs, this does not mean you cannot use our workflow. In this case, you will have used the RAW converter built into your camera. All steps that are applied after a RAW conversion are valid for JPEG images. Even if you don't use RAW, it probably is helpful to better understand what RAW is all about.

What are the RAW file advantages?

To better understand what these magic *RAW file formats* are, you must understand how the majority of today's digital cameras work. All new digital cameras capture color photos, right? Well, you ultimately get color prints, yet most modern digital cameras use sensors that only record grayscale values (the Foveon X3 sensor, digital scanning backs and multi-shot digital backs are exceptions).

Assume you want to photograph a box of Crayola crayons:

◂ *Figure 1.1: Full colored sample target*

A gray scale sensor would see the picture as in the figure 1.3. You would never see any color photos at all.

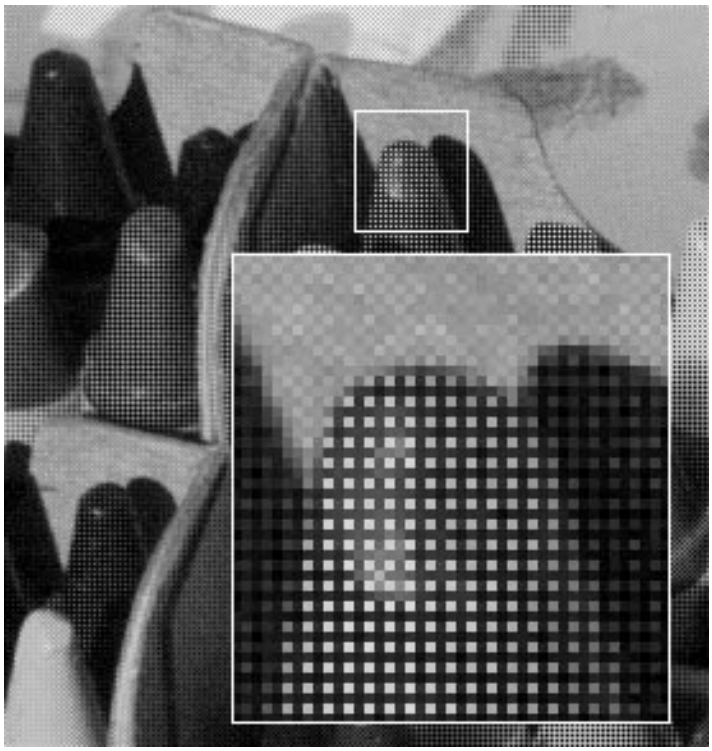


Figure 1.2: ›Grayscale picture‹ seen by the sensor

How do you use a grayscale sensor to capture color photos? Engineers at Kodak came up with the following method called Bayer Pattern. Dr. Bayer is a Kodak scientist who invented this novel Color Filter Array configuration back in the eighties. Hence the name Bayer pattern. There are also other pattern variations used):

B-G-B-G-B-G
G-R-G-R-G-R
B-G-B-G-B-G
G-R-G-R-G-R

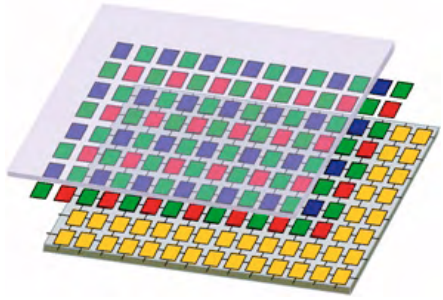


Figure 1.3: Bayer pattern achieved by a matrix of color filters

First, it is interesting to note that 50 % are **green** and only 25 % for each **red** and **blue**. The reason for this is that the human eye can differentiate far more green shades than red or blue. Not really a surprise if you look at nature. Green also covers the most important and widest part of the visible spectrum.

Now our sensor captures gray values filtered by these color filters:

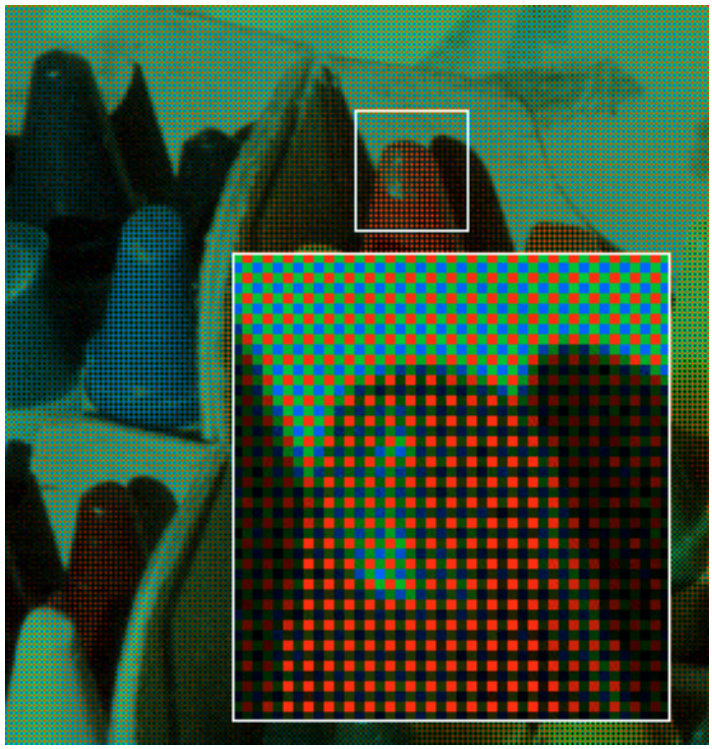


Figure 1.4: Color mosaic seen through the color filters

However, you want to have a photo with full-color information for every pixel. Here a software trick comes into play called Bayer Pattern demosaicing or color interpolation. What actually happens is that the missing RGB information is estimated from neighboring pixels.

A good demosaicing algorithm (the method of turning the RAW data into a full color image) is actually quite complicated, and there exist many proprietary solutions on the market. The problem is to resolve detail and maintain correct colors. To illustrate some of the challenges, think of capturing an image of a small black & white checker pattern, small enough to just overlay the sensor cells:

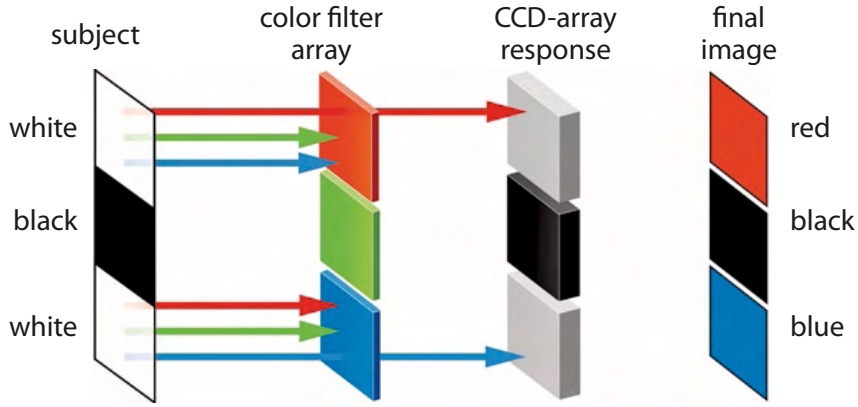


Figure 1.5: CCD / color mosaic sensor with color interpolation errors

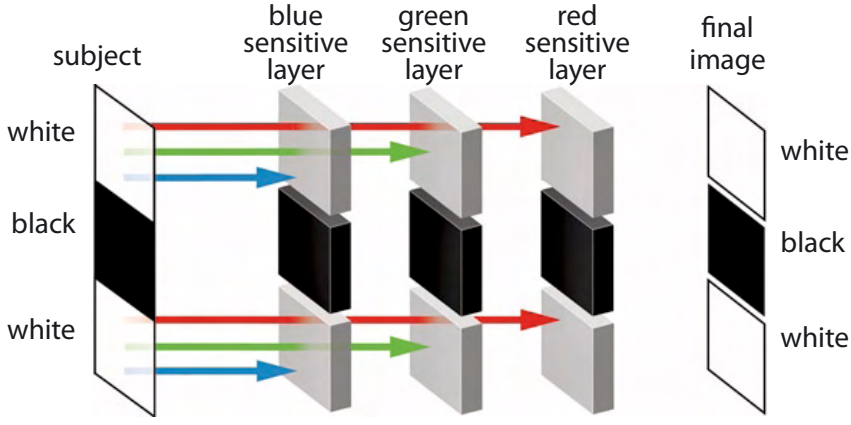
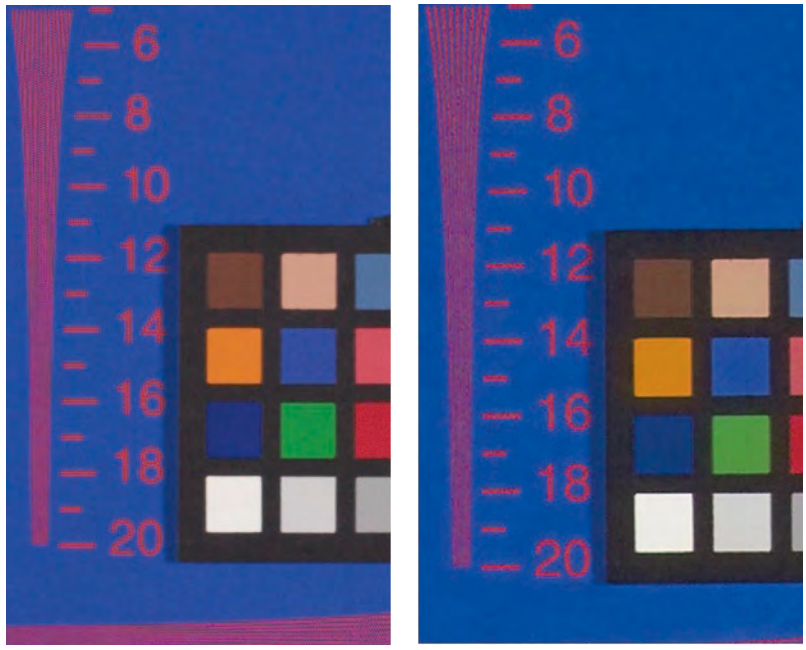


Figure 1.6: X3 sensor with no color interpretation errors

As the neighboring green filtered photo site does not add new information, the algorithm would not know whether it would be some kind of "red" (if the white hits a red filter) or "blue" (if the white hits the blue filter). In contrast, for example, a Foveon sensor would capture white and black correctly as all three color channels are captured at the same photo site. The resolution captured by the Bayer sensors would drop if the subject only consists of red and blue shades, since the green channel could not add any information. For monochromatic Red/Blue (very narrow wavelengths) the green sites get absolutely no information. But such colors are rare in real life. In reality, there is information in both green, and to a much lesser extent, even blue, if the sensor samples very bright and saturated red colors. The problem in our example above is the fact that estimating the color correctly requires a certain amount of spatial information. If only a single photo site samples the red "information"

there will be no way to reconstruct the correct color for that particular photo site.

The above next cropped illustrations are from real samples that were made in a studio to show a practical effect. Of course, these test photos here show an extreme situation. In reality the failure is less dramatic but is still visible by our eyes and definitely not to be ignored.



Canon EOS 10D Sigma SD9 using the Foveon sensor

Figure 1.7: Fooling a Bayer sensor

Some of these challenges result in image artefacts like moirés and color aliasing (shown as unrelated green, red, blue pixels or resulting in discoloration). Most cameras fight the aliasing problem by putting an AA (*Anti-Aliasing*) filter in front of the sensor. This filter actually blurs the image and distributes color information to the neighboring photo sites. As you know, blurring and photography aren't compatible. To find the right balance between blurring and aliasing is a camera design challenge. In our experience, the Canon 1Ds does this job well. Finally the image needs stronger sharpening to re-create much of the original sharpness. To some extent AA filtering degrades the effective resolution of a sensor.

This appears as a complicated mission. Indeed it is, but works surprising well in the end. Every technology has to struggle with its

inherent limitations. In many aspects, digital photography can beat film today because film has its own limitation to contend with.

We can state what the RAW data are for any given digital camera. The RAW data are, in fact, all the data for gray values captured on a chip. To produce a final image, these RAW data require processing (including the demosaicing) by a RAW converter. To produce JPEG images, the camera must have a full RAW converter embedded within the camera's firmware.

What are the limitations of using camera-produced JPEGs:

- JPEG artefacts, due to lossy compression
- Although most sensors capture 10–14 bit color (grayscale) information only 8 bits are used in the final file
- The in-camera RAW converter can only use limited computing resources but good RAW conversion can be very complex and computer intensive. As software technology evolves, it is much more efficient to have the conversion done on the host computer instead of the non-upgradeable ASIC commonly used today.
- The in-camera set or estimated white balance (WB) is applied to the photo within the camera. The same is true for color processing, tonal corrections, and in camera sharpening. This limits the post-processing capabilities, because a previously corrected image must be corrected again. The more processing done on a photo (especially 8 bit) the more it can degrade.

Next we explain the different RAW files formats. The formats store only RAW data (plus additional metadata to describe properties of the RAW data in EXIF section of the file – the EXIF sections hold information, such as camera type, lens used, shutter speed, f-stop and more). All the processing previously done shooting JPEGs or TIFFs in the camera are now ready to be performed on a more powerful computing platform with:

- No JPEG compression
- Full use of the 12-bit color information (10–12 bit)
- Use of very sophisticated RAW file converters (as an example, Adobe Camera Raw, Phase One's Capture One DSLR or Pixmantec's Raw Shooter Essential)

- White balance, color processing, tonal/exposure correction, sharpening and noise processing can be processed later on in the computer
- The RAW files also resemble a digital version of an undeveloped film negative. Over time, there are improved RAW file converters that give better and better results from the same data.

This all confirms the fact, that shooting in RAW gives you much greater control while processing your images.

In-camera JPEGs are similar to shooting a Polaroid (where you simply shoot and receive your image processed immediately) while RAW is more like a film that can be developed and enhanced in the dark room. Raw converters like Phase One's Capture One DSLR mimic a magic formula for film developer.

What is the advantage of 12-bit data? The main advantage exists if you need to make major corrections to the white balance, exposure and color corrections. During processing of an image, you lose bits of image data due to data clipping (accumulating over multiple steps). The more bits you have in the beginning the more data you have in your final corrected image.

What about using TIFF files in the camera? Actually TIFF files only solve the lossy compression issue, but are still converted to 8-bit inside the camera. Most TIFF files are larger than RAW files (remember RAW files only hold one 12-bit gray value per pixel) and don't have the other benefits of RAW. I would go so far as to say that an 8-bit in-camera processed TIFF file is only slightly better than a high-quality / high-resolution JPEG.

Digital camera artefacts

Current sensors do not record full RGB color but only interpolate the color but, at a price.

Color aliasing / moirés

What happens when a fine red line crosses a green photo-site but not any neighboring red photo-sites? There would be no indication of this red line in RAW data. To combat this effect, most cameras have fixed-mounted AA filters. These AA filters blur the image so that neighboring photo-sites also acquire some red line information.

While the AA filter fixes one problem, it introduces a different one, a loss in sharpness. This means that some strong sharpening is needed later during the RAW workflow. Keep in mind, lost detail cannot be recaptured later regardless of whatever fancy sharpening methods are used. Sharpening does, however, do quite a good job, and digital cameras work much better than this description of it sounds.

1.6 The digital negative/slide

What you now have on your computer when shooting RAW are often called "digital negatives". We recommend you keep these RAW (or original JPEG or TIFF) files as they hold all the information captured in the field. You may want to revisit these original RAW files in case:

- You improved your own digital workflow over time (very likely)
- Better RAW converter software will be available. We have seen many improvements over the last four years and expect more to come.
- You lost your derived files

Actually, a RAW file is even more like a latent image and the RAW converter software acts like your preferred magic developer. The only big difference in digital is that you can do multiple kinds of development over time.

1.7 Some strategic reasoning

Like many pads lead to Rome, there are many ways to shape your digital workflow. The most appropriate way for you depends on the kind of photographs you shoot, the purpose you intend for your images, on your equipment and on personal preferences, as well. To setup a workflow that suites your work best, you might give different workflow variations a trial, then finally settle on a workflow, which can be adapted in special cases:

Several steps in the processing of an image – e.g. white balance, sharpening, contrast enhancement, saturation enhancements, …) may be done at three different stages:

- Inside the camera (some of the operations mentioned above, even if you shoot RAW files)
- Inside your RAW converter
- Using Photoshop or some Photoshop Plug-in

Doing an operation at an early stage doesn't necessarily mean you may not do it again at a later stage. For example, there are reasons to do some sharpening globally with the RAW converter and add more sharpening with Photoshop. In Photoshop, sharpening may be applied to either the whole image or to certain edges or areas. You may even want to do some final sharpening when preparing for a dedicated form of output (e.g. an image printed using an inkjet printer or offset printing requires more sharpening than an image presented on screen or using a light jet printer). Inside the camera or a RAW converter, you may apply changes only globally (to the whole image) while Photoshop allows selective corrections using selections, masks, layers or filters.

The general rule is that corrections done in the camera or – with more control – in the RAW converter will result in less loss of quality. This is especially true concerning good exposure, which correction should be done within the camera. But correcting exposure values with the RAW converter is much better than done within Photoshop.

White balance ▸ When you shoot RAW files, it is useful to set a proper white balance in the camera, because this value will be used as a default and starting point for your white balance inside the RAW

converter – however it is only a starting point and may be changed without loss of color quality. White Balancing is one of the most important tasks in a RAW converter and should largely be done there.

With those cameras that support Black&White (B&W) shooting, you may consider a B&W setting if your are sure, you only want B&W. Shooting color however gives more control and more options. You may do a color to B&W conversion either inside the RAW converter or do it in Photoshop (see chapter 12).

Sharpening, saturation, contrast enhancements ▸ Apart from the exposure and white balance settings, all other settings, such as sharpening, saturation and contrast enhancements should be deactivated or set to the lowest possible value when you shoot RAW files.

Up- or Down-sampling ▸ As for scaling, we recommend using the highest resolution available with the camera, and do up- or down-sampling either in the RAW converter or in Photoshop. Photoshop, as well as Capture One and Raw Shooter, support a reasonably good up-sampling, however offer only some fixed sizes. If you wish to prepare an image for large-scale printing, it may be helpful to do a rough up-sample in Adobe Camera Raw and a final sizing in Photoshop.

Cropping ▸ Cropping is offered by Adobe Camera Raw 3 (or newer), by Nikon Capture and by Raw Shooter Essentials if you are certain your image needs cropping. This results in smaller image files, thus faster processing.

Which RAW converter to use

There are several RAW converters available, and their number is increasing over time. Almost all DSLRs come with a native RAW converter. This may be a Photoshop Plug-in or a standalone RAW converter (or both). E.g. Canon cameras supporting RAW format come with Canon EOS Viewer Utility (EVU for short) and Canon Digital Photo Professional (DPP for short) – both applications are a free part of the camera package. If you use Photoshop CS1 (alias Photoshop 8) or CS2 (alias Photoshop 9) or even Photoshop Elements 3 (or later) a good RAW converter is included, as well. If you use a picture database or good picture file browser – also referred to as "Digital Asset Management Systems" (or DAMS for short), it probably will have a

RAW converter of its own. There are some optional RAW converters as well – e.g. Capture One (by Phase One), Nikon's Capture, Bibble (by Bibble Labs) or Raw Shooter by Pixmatec, just to name a few. Which one should you use?

There is no single answer to that. It very much depends on your requirements and work – and it may change over time.

Those RAW converters that are part of a DAMS system such as ThumbsPlus, iView Media Pro or Extensis Portfolio are primarily intended to produce a reasonable preview. Though they may be used to convert a RAW file to TIFF or JPEG, that is not their primary focus. For that reason, you seriously consider doing your actual RAW conversion using one of the "real" RAW converters. The range of formats and cameras supported by the various RAW converters differs. Nikon's tools, for example, only support Nikon cameras. The same is true for Canon's tools with Canon's cameras. Adobe Camera Raw, Capture One, Raw Shooter and Bibble all support a wide range of formats – however, be sure you check to see if they support your camera. Some converters are faster than others, and some offer a better workflow integration than others. For that reason alone, we recommend you read the description of all the RAW converters we include in chapter 3 to 6, do some testing (a trial version of most converters is downloadable from the internet) and settle on that converter that best fits your needs and budget. Sometimes it may be useful to use more than one converter, depending on the type of work and the images you have to process.

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Chapter 2

Basic Color Management

Camera: Canon 1D Mk. II

Usually, when working with photos, we work in color. Thus, it is very important that the color we see on our monitor closely matches the color seen by the camera when a photo is taken.

Likewise, when white balancing, fiddling with color saturation, or performing other color corrections or contrast enhancements, we want to be sure that the color we see on our monitor represents the color values of our image, and that if we print our image (once all optimizations and enhancements are finished), the colors in our print will be very close to those we saw on our monitor. This is what *color management* is all about. Of course, in order to do efficient

color work, you must understand the basics of color and color management.

Color management is one of the more demanding subjects in digital photography, and has, itself, been the subject of entire books. Because of this, we give you only a short introduction to color management, with a focus on those parts important to our workflow. It is strongly recommended that you read more about color management. There are several good books on color management, such as *Color Confidence* by Tim Grey ([1]) or *Real World Color Management* by Bruce Fraser ([2]).

2.1 Understanding the different color modes

Photoshop supports several different color models. A color model defines how colors in an image are described using numerical values. The main color models for photographers are these:

- RGB
- LAB
- CMYK
- Grayscale

Photoshop offers additional color modes, but photographers rarely use them, thus a discussion of them is beyond the scope of this book. These include *Bitmap* for pure black or white (bitonality) images, and *Index mode*, used primarily for web graphics (if you can live with fewer than 256 different color values). *Duotone* is used for B&W images and allows for the addition of a second color to give the print more depth.

Color depth: Returning to the term *color model*, you may use either 8-bit (one byte) to specify the amount (or percentage) of a single value (e.g. red) or 16-bit (2 bytes). Thus you may have your image in 8-bit or 16-bit mode. A different bit length is possible, but not supported by most applications. Using 16-bit doubles the space needed to store the values, but gives you more headroom when it comes to differentiating color values and allows for a more precise calculation with less rounding errors. Using 8-bit, the value of a single component may vary from 0 to 255 (using integers), using 16-bit, the range runs from 0 to 65,536 (actually only 15-bits are used, so the range

becomes 0 to 32.768). Though we recommend using 16-bit whenever possible and reasonable, for most explanations we use 8-bit values (0–255). This is common practice. For most issues in color management, it doesn't matter which mode you use. When producing final output, e.g. printing, you will be required to reduce your image to 8-bit mode, since nearly all real devices can't actually produce more than 256 different shades of a color (taking into account a combination of the three primary colors of RGB, this adds up to 16.777.216 different colors). Even our eyes can only differentiate about 120–200 different shades of a color, depending on illumination. During the phase of color optimization, however, where a large amount of color shifting and transformation and lots of calculation of color values is done, 16-bit is the better mode.

RGB color model

All colors in the RGB color model are created from three primary colors: red, green, and blue. RGB is the color mode most commonly used today in digital photography. We will perform our workflow mainly in this mode. RGB is an *additive color model*, meaning that the sum (addition) of all three basic colors at full strength (100 percent) will add up to pure white.

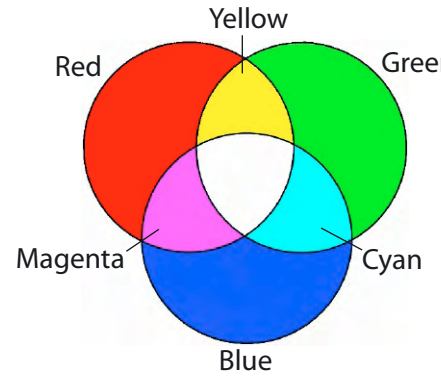


Figure 2-1: The RGB Color Model

Triple (0, 0, 0) defines black while (255, 255, 255) is bright white (Either should rarely occur in any photo).

As you will learn a bit later, pure RGB values without an additional reference to the device or color space these values are used for, do **not** define colors in an unambiguous way.

LAB color model

The *CIE-LAB color model* (often spelled Lab, LAB or L*a*b*) separates colors (chroma, A+B) from the detail and brightness (luminance, L) in images. As in RGB, Lab uses three basic components to build (or describe) a color: *L* (for Luminance), ranging from Black (0 = no light)

to white (100), and two color axes: *a* and *b*. The a-axis is a Green to Red and the b-axis, Blue to Yellow.

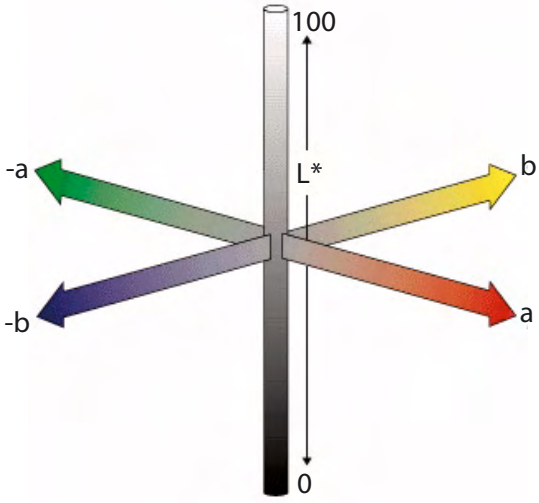


Figure 2-2: LAB color model

CMYK color model

The CMYK color model uses four primary colors to define a color: Cyan (C), Magenta (M) and Yellow (Y) and Black. CMYK was designed for printing, where incoming light is reflected by the print.

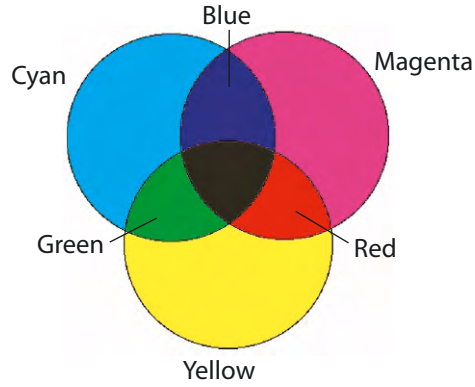


Figure 2-3: CMYK Color Model

CMYK is a *subtractive color model*, as each of these colored inks absorbs (subtracts) a certain spectrum of light. As you see in figure 3, mixing cyan and magenta gives you blue, and when you add magenta to yellow you get red. In theory, the combination of the colors C, M, and Y alone should be sufficient to produce black, but due to certain impurities in inks, they produce a dark muddy brown instead. To solve this problem, a fourth color, black, is added, and is called the *key color* (K for short).

Although CMYK is an important color model for the printing press, it is not used much in digital photography. Though inkjet printers are technically CMYK printers (most are even CcMmYK with

additional light Cyan and Magenta inks), they provide an RGB interface to the user and the transformation from RGB to CMYK is done by the printer driver in an almost transparent way.

We rarely use the CMYK color model in our workflow. Even if you intend your images for printing preparation, which requires CMYK, you should stick with RGB mode images whenever possible and resort to an RGB to CMYK conversion as the very last step (some additional sharpening and some slight increasing of saturation may be required afterwards for the final touchup). Working on photos in CMYK mode has some disadvantages:

- CMYK images are larger than RGB (with four color values per pixel instead of three with RGB).
- Some photo filters won't work in CMYK mode.
- The CMYK color space usually has fewer colors than most RGB color spaces. Thus, when you convert from RGB to CMYK, you probably lose some colors, and there is no way to retrieve them should you want to later use your image for something such as lightjet printing (used by photo services to output your image on photographic paper) or a digital presentation using a monitor using RGB colors.

Grayscale mode

Photoshop also works with images in pure black and white (B&W) or grayscale. However, when working in grayscale, the color of a pixel only describes a single (gray) value. Consequently, even when you intend to produce a B&W photo (grayscale photo), it is recommended using RGB mode, to preserve color information.

When using Photoshop's bitmap mode, a picture has only two possible color values: black and white, no gray. Bitmap mode is rarely used for photographs, and most imaging techniques and filters do not support bitmap mode.

Color spaces

A *color space* is the total range of colors (or color values) real devices, such as a monitor or printer or a virtual device (such as a *theoretical average monitor*, represented by the sRGB color space) can record or reproduce. This range defines the *gamut* of the device.

Every real device has a unique color space, and even identical devices (of the same make and model) have slightly differing color spaces, e.g. due to different age, production tolerances and so on. These differences increase with variations in user selected hardware- or software-settings, such as different monitor resolution, different printer inks or paper, or even a different brightness setting on a monitor.

To improve our ability to work with colors, the International Color Consortium (ICC for short, see also [13]) and some other companies (e.g. Adobe, Kodak, Apple) have defined *virtual color spaces* that represent the gamut of a virtual, rather than a real device. We will see later, what the advantage of those virtual, standardized color spaces really are.

2.2 Understanding color management

Color correction and *color management (CM)* are two of the most important and difficult areas to master in digital photography. As stated earlier, the goal of color management is ensure that the photo you see on your monitor looks as much as possible like the print you'll get from your printer and very much the same when you send it to a photo service that will reproduce it using a lightjet printer. Color management helps to reproduce colors as truthfully as possible across a broad range of different devices. As an identical reproduction is often impossible due to different ways different devices produce color, you should at least be able to predict the color you'll get when printing from the color you see on your monitor.

The ability of a color managed application to show (simulate) on your monitor the colors and the impression that an image will have when printed on a specific printer or other output device is called *soft proofing*. If you actually print using the same inks and the same paper used for final output, this is called *hard proofing*.

Why you need to understand color management

If you post a photo on the web and ask different people to discuss its color quality, responses will be altered by the fact that when the image is displayed on different monitors (without using color management), the result will show colors, which are at least slightly dif-

ferent on all monitors. The viewers will actually see different versions of the same photo. In fact, the monitors may not even be capable of rendering some RGB values at all. It is the domain of color management to significantly reduce the problem described here.

The challenge

Your challenge is to have a monitor present the correct impression of how a certain photo would print on a color printer. The latest inkjet printers can produce amazing results, but without proper color management, color printing remains trial and error. You end up changing the printer's color settings for every print, with usually less satisfaction.

The solution

The solution to the color problem is to determine the color characteristics of a device and to take those characteristics into account when reading colors form an input device or when sending color to an output device. Additionally you put a tag on color images that define how the color values of the image are to be interpreted.

ICC-profiles

An important concept of color management is the production of a standardized description of a device, called an *ICC profile*; the format of these profiles is defined by the ICC. The ICC color profile describes a device's color characteristics, such as the colors the device can record or reproduce and the values recorded for a perceived color (input device) or the values you must send to an output device to produce a certain color. These profiles are either from the device manufacturer (usually called *generic profiles*), or you produce your own using special profiling hardware and software. A profile produced for your specific device is called a *custom profile*. Almost all color management systems today use ICC profiles. With the help of such a profile, the color values required to produce a specific color on device A (e.g. a monitor) can be translated to values that will reproduce that specific color an device B (e.g. a printer) as close as technically possible. It also describes the gamut of the device.

Note: While a raw RGB value does not define color in an absolute way, the color produced is very much dependent on the device

used or on the device that recorded that value. An RGB value in the context of a color space (defined by the ICC profile of the color space) however, does define an absolute color!

Note: Because most people use their monitor as their soft proofing device, the first step toward complete color management is to profile your monitor.

Let's return to the problem when receiving a sent image that (without color management) displaying different colors on different monitors. With the help of the input profile, a color management system may correctly interpret the RGB values of the (input) image and, with the aid of an ICC profile for your monitor, may transfer them to color values producing (nearly) the same color on your output device. How this is done, we see in the next section.

What is a color management system?

A color management system (CMS) is a set of program modules that handle color translation. These modules are often part of the operating system but may be provided by applications, as well (Adobe does this). If an application is used to display or print a color image, it calls up these functions and hands over the image values and ICC profile information and tells the CMS what function should be performed. The central part of the CMS is a module called color management module (CMM). This does the calculations needed to translate (transform) a color from color space A to color space B. Here's how it works:

1. First the *color management module (CMM)* translates the device dependent color values of the image to a device independent color space, using the description of the source ICC profile. Now the color values of the image are in Lab color space, which is device independent. This intermediate space is called *transfer color space* or *profile connection space* (PCS for short).

2. Next, these LAB-values are translated to color values that will produce a color on the output device that is as close to the original color impression as possible. If the output device cannot produce the very same color, the CMM will try to find a close match. How the best match is achieved, is determined by the translation intent (which we will explain at page 2-14).

The ICC profiles used in this scheme are actually simple translation tables. They support translation from device dependent color values to the device independent color values (and vice versa).

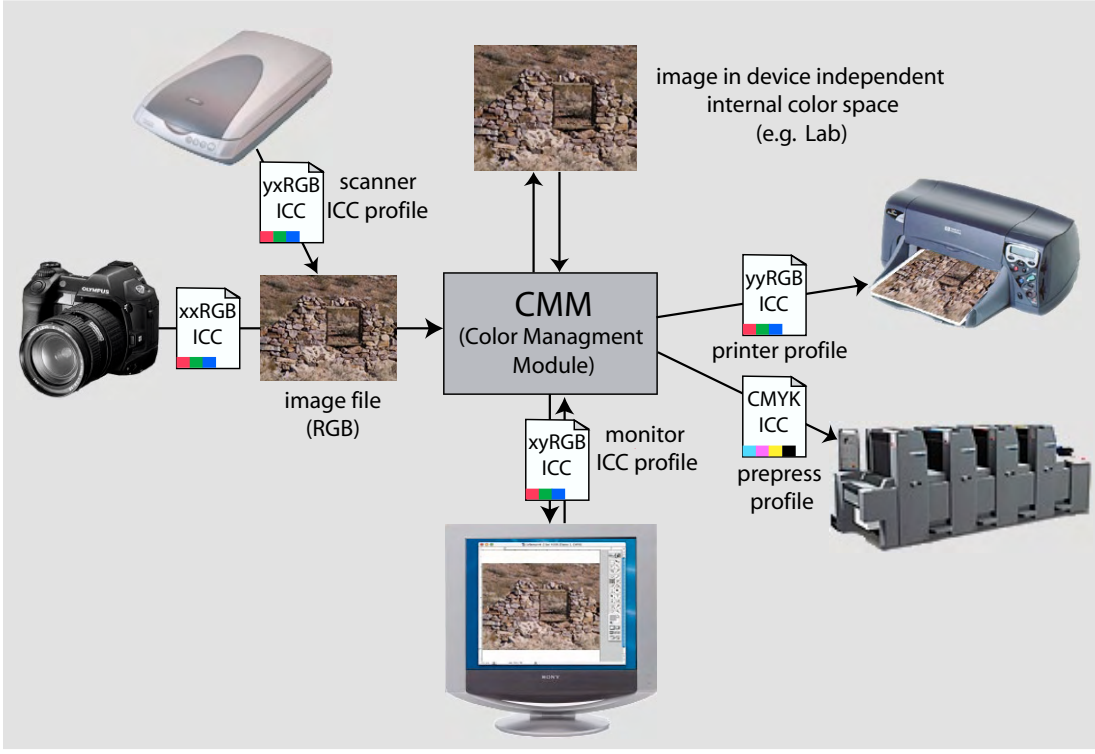


Figure 2-4: How color profiles function with a color management system

Photoshop, and other applications that support color management, embed the ICC profile data within the image file, and the files with this embedded information are called *tagged files* (or *tagged images*). When you pass the tagged image along, the profile information is passed along as well. You should be beware that not all image file formats can include ICC profiles. While TIFFs and JPEGs can, GIFs cannot.

Note: Avoid applications not using or creating these embedded profiles and also do not support use of monitor profiles. The color of the image they display on the monitor or print may or may not be correct or even close to the true colors. You will not know. Some applications may even remove the profiles from your image when editing without telling you.

Color working spaces

It is a bit tedious to work with a large number of different device dependent color spaces. This is why virtual, standardized color spaces were defined. These do not describe a gamut of a real device but for an abstract (virtual) device. There are several different such spaces for each of the color models (RGB, Lab, CMYK). They range from narrow to broad gamut. For example, for the RGB color model, there is (from narrow to wide) sRGB, Apple RGB, Adobe RGB (1998), ECI-RGB and Pro Photo RGB (and several others).

To eliminate a specific working space (including its ICC profile) of your input device, you usually convert your image from the original input color space to a standardized color space and continue to work on your image using this working space. With digital photos, you may accomplish this conversion using the RAW converter.

Why define several working spaces for a color model? These spaces differ mainly in the color range (their gamut) they cover. In some workflows, it is advantageous to use a narrow color space, while in others, a wide space is better. If your input device has a wide gamut (such as digital cameras), you should use a work space with a wide gamut if you intend to produce output for several different output methods (e.g. inkjet printer, lightjet printer, monitor, etc.). If you convert your image to a working space with a narrow gamut, you may lose some colors that could be reproduced by some of your output devices. If, however, you use a working space with a very wide gamut, the numbers (bits) representing color values may not be sufficient to differentiate the many different colors your gamut allows (with 8-bit there are only 256 discrete values available). Many of these discrete values may be lost, because your image may never have colors that extend to the outer edge of the theoretical gamut of the space. This may get worse if you have to do a lot of correcting, rounding and transformations. For this reason, we recommend using 16-bit mode, when you intend to use a color space with a wide gamut.

The following list shows some of the most important color spaces for photographers:

- **sRGB**: This color space was designed to be used with monitors, and is probably a good one for photos to be presented on the Web. It defines a gamut that can be displayed by the average

monitor, which is a relatively small color space. Though many DSLRs allow you to produce images using this color space, sRGB color space is much narrower than the color space than the cameras can see and record.

- **Adobe RGB (1998):** A color space very popular among Photoshop users. It has a larger gamut than sRGB and covers most printable colors. This is the color space we use for digital photos.
- **Pro Photo RGB:** This color space was defined and is supported by Kodak. It provides a very large gamut and should only be used when working with a color depth of 16-bit.
- **Apple RGB:** This color space was defined by Apple Computer and is commonly used with Macintosh systems. Its gamut is wider than that of sRGB but smaller than that of Adobe RGB.
- **ECI-RGB:** This color space was defined by ECI, the European Color Initiative – a group of companies attempting to define color production standards in Europe. The ECI-RGB color space was designed to include all colors that may be reproduced by printers. Its gamut is somewhat wider than that of Adobe RGB and includes some green colors that can be reproduced by many printers (inkjet and offset, as well as gravure), but which are not part of either sRGB or Adobe RGB (1998). ECI-RGB is the standard RGB color space within the European prepress industry and serves as the European alternative to Adobe RGB for prepress work.

Visualization of color spaces

Color spaces are actually three-dimensional (L-, A-, B-axis). The profile shown in Figure 2-5 is that of sRGB, using the ColorSync utility of Mac OS X. The gray outer space shows the gamut of Adobe RGB (1998) and allows comparing these two color spaces. As can be seen, Adobe RGB is a superset of sRGB.

Figure 2-5: 3D diagram of sRGB (color) and Adobe RGB (1998) (gray shape)

The industry also uses some form of 2D charts to display color spaces. The color space plot shown in Figure 2-6 was generated with the GretagMacbeth Profile Maker Pro 4.1 Profile Editor.

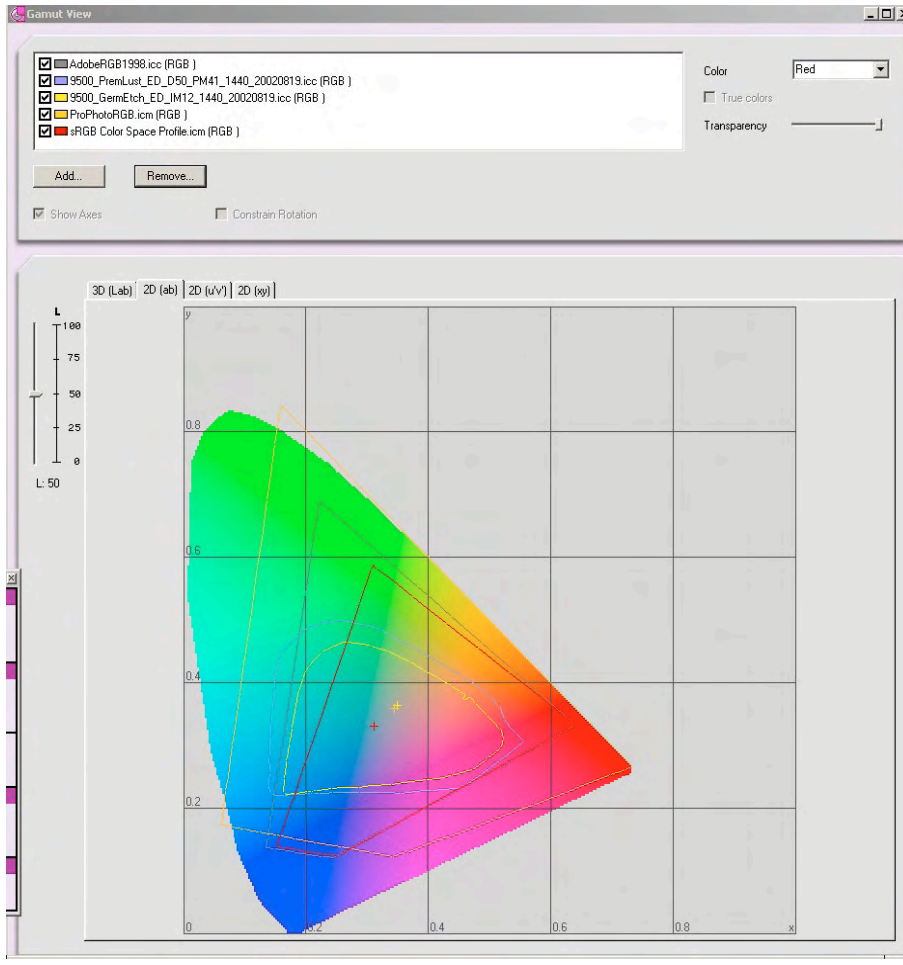


Figure 2-6: Gamut Display (using Profile Maker Pro 4.1 Profile Editor)

As seen in the diagram of figure 2-6, Pro Photo RGB is extremely wide, while Adobe RGB (1998) is much smaller and sRGB is very narrow.

We often use "Hahnemuehle German Etching watercolor paper" for printing with our inkjet printers. The gamut that may be reproduced using this paper using Epson's UltraChrome inks exceeds sRGB but fits into Adobe RGB. The color space of the "Epson Luster paper" has a much wider range than that of "Hahnemuehle water color paper" (no surprise here) and exceeds both sRGB and Adobe RGB (in some blues and greens). If you have ICC profiles describing different printing sets (combinations of printer + ink + paper), a display like the ones shown above allow you to compare the gamut and thus the color richness you may achieve using different papers.

Color space mapping

When images need to be converted from one color space to another, for example, when displaying an image on a monitor, the image is transformed from its source color space (device color space or working color space) to that of the output device (your monitor, in this case). In most cases, the gamut of the source and the destination are different, so some color mapping has to take place. This transformation is performed by the color management module (also called the color management engine).

The main question is: What to do with those colors of the source space, that are not present at the destination space? Because there are several ways to handle this problem, ICC has defined four different ways of mapping, called *intents*:

Perceptual (also called **Photographic**): If the gamut of the source space is wider than that of the destination space, all colors are compressed to fit into the destination space. If the gamut of the source space is smaller than the destination space (all colors of the source are present at the destination space), a one to one mapping takes place (all colors keep their original appearance).

When mapping from a wider space to a smaller space, the Perceptual mapping usually shifts colors to a bit less saturated and somewhat lighter colors, but the overall impression of the image is preserved (different colors keep their relative color distance). Perceptual mapping is one of the two intents we use when converting photographs (the other being *Relative colormetric*).

Relative colormetric: When you map from a wider color space to a smaller color space and a color in the source space is not present at the destination space, it is mapped to the closest color at the destination space, which usually lies at the border of the destination space.

With this mapping, two colors different in the source space and not present in the destination space may be mapped to the same color of the destination space (usually residing at the border of the that space). This may result in some color clipping or banding. The white point of the source space is mapped to the white point of the destination (if they differ) and all colors are adapted relativ to the destination white point.

The Relative colormetric intent is useful for photographs, and should be used when the source and the destination spaces have a similar gamut with lots of overlap or if most of the colors in your image (which may not use the full gamut of the source space) have an identical color in the destination space. In this case, most colors remain unmodified when transformed. This intent is used implicitly, when colors in your image are translated to colors on your monitor when an image is displayed in standard mode.

Absolute colormetric: This intent is like a relative colormetric, where colors present in both color spaces are mapped 1:1, and colors that are *out of the gamut* (a color of the source space, that is not present in the destination space) are mapped to the border of the destination space. This mapping is particularly useful if you wish to use your output device (say your monitor) to simulate the behavior of another device.

You should use this intent **only** for soft proofing: When you want your monitor to display what your image will look like when printed on an inkjet or with offset printing. In this case, the monitor simulates the white color of the paper.

Saturation: This intent tries to map an out-of-gamut color to a color of the destination space with the same saturation, even if the color has to be shifted significantly. Use this intent when converting logos and colored diagrams from a larger color space to smaller one. For photographs, it is absolutely of no use! This intent tries to keep the visual difference of two colors but not their color impression.

Creating device profiles

The introduction above emphasizes the importance of using accurate device profiles. As most of our digital work is done using the monitor, when setting up a color managed workflow we need to consider monitor profiles as our most important task. In this section, we turn our attention to how to build a device profile.

When profiling a device, there are normally two steps:

- **Calibration.** The aim of calibration is to define a *standardized state* for the device, setting its controls so that it is in a state, as close to this defined state as possible. For example, when calibrating a monitor, you manually set the controls of your monitor

to achieve a certain *luminance* (brightness of your monitor's white) that has proven to be good for color work. Also, you set a *white point* conforming to an industry standard, such as D50 or D65 (color temperatures of 5,000 or 6,500 Kelvin respectively). The *white point* of your monitor is a mix of R, G and B that will represent *white*.

- **Characterization.** When characterizing a device, a *target* is recorded by the input device, or sent to an output device. A target is a pattern of color patches with known color values. By comparing the color values recorded by the device (such as a scanner) to the known color values of the target, the profiling program can calculate a device's *color profile*, using essentially a translation table of device-dependant color values to device-independent color values or vice versa. As an example, if the profile is for an input device, it translates device-dependant colors seen by the device into the device-independent profile connection space (PCS, which is CIE-LAB space). If, on the other hand, it is for a profile of an output device, the table provides translation from the profile connection space to the device-dependant colors of the output device.

To perform both steps it is advisable to use a hardware device to measure color. When calibrating monitors, the device could be either a colorimeter or a spectrophotometer.

As the focus of this book is on the processing of RAW files, we provide a very brief overview of profiling, with only a bit deeper discussion of profiling a monitor.

Camera profiles

There are two types of camera profiles: *generic camera* and *custom camera profiles* which profile specific cameras. All RAW converters we discuss come with quite good generic profiles. Some of them (e.g. Raw Shooter and Capture One) also support customer profiles.

Creating your own camera profiles can be very tricky, since targets must be shot under highly controlled light conditions. Additionally, individual cameras of the same model can vary significantly (certain cameras vary more than others within type and brand). For more details on camera profiling see chapter 11.

Printer profiles

There is no single profile for a printer. A printer profile is always specific to that printer using a specific paper and ink set, and a specific driver and its settings (such as the same DPI). To make life interesting, profiles for different types of printing paper also vary significantly.

Note: While some newer inkjet printers may vary little between individual printers of the same make and model, profiles should still be generated for each printer and its specific settings.

When profiling a printer, a target is printed, using precisely the printer settings, ink, and paper that the profile is intended for. Once the print has dried (anywhere from 1 to 24 hours) the color values of the print are measured using either a spectrophotometer or a profiled scanner (less accurate). By comparing known values of the color patches of the target to those of the measured patches of the print, the profiling software produces the printer profile.

Fortunately, you don't need to invest in a costly spectrophotometer and profiling software; you can use several profiling services, which do this job for you. Look up "printer profiling service" at Yahoo or Google.

2.3 Profiling your monitor

As stated before, an accurate monitor profile is the basis for serious color managed workflow. When calibrating your monitor, you have a choice of doing so by eye or with specialized hardware.

When profiling your monitor, begin by turning it on and leaving it on for at least 30 minutes before beginning any calibration. To perform the calibration follow the instructions provided by your choice of tool, whether calibrating by eye or using hardware-based tools as discussed below.

Be aware that room lightning, the color of your walls and desktop and even your clothing can influence precise calibration.

Calibration by eye

Photoshop for Windows comes with a utility called *Adobe Gamma* that lets you calibrate your monitor. With Mac OS X there is a similar little utility called *ColorSync Calibrator*. Both utilities use your eyes as their measuring instrument.

Hardware based calibration

Although calibrating your monitor by eye is better than doing no calibration at all, if precision is important to you, you should use a hardware based color measuring device (a color spectrophotometer or colorimeter) to achieve much more precise results. While the software and hardware for monitor profiling used to be quite expensive there are several packages currently available for between USD $100 – $300 for a complete kit. Your choices include: GretagMacbeth *Eye One Display 2* (see [15]), ColorVision Spyder and Spyder Pro products (see [16]), and MonacoOPTIX from Monaco Systems (see [17]).

We use and recommend GretagMacbeth Eye-One Display 2 and the Sony Artisan monitor (which provides an integrated solution with a monitor and a special measuring device).

The entire calibration and profiling process will take you about 10 minutes. Once a good calibration is achieved, the next calibration will be much faster.

Calibration settings

As there are several options when calibrating and profiling a monitor you have to decide which settings to use when starting your calibration. Without going into too great detail, we recommend using the following values:

White point	6500 K (D65)
Gamma	2.2
Luminance	130–150 cd/m^2

We recommend these values even if you do prepress work (where a white point of 5 000 K is the standard) and even if you work on a Mac where a gamma of 1.8 is tradition.

Calibrating and profiling using Eye-One Display 2

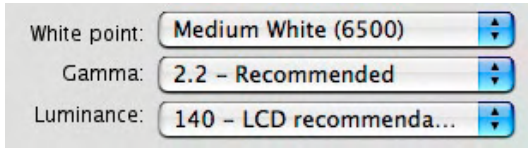
The Eye-One Display package from Gretag Macbeth ([15]) includes software (Eye-One Match) for calibrating and profiling monitors as well as a sensor (colorimeter). It supports Windows as well as Mac OS and allows the calibration of CRTs as well as LCDs and laptop displays. To use it to calibrate your monitor:

1. Launch Eye-One Match (EOM) and select the monitor from the list of devices you can profile. We recommend using Advanced mode.

Eye-One Match
Eye-One Match 3
Select the device you wish to profile
Help
Monitors
This is the online help! It will guide you through every step of the profiling process.
Choose the device you wish to profile from the options on the left. Browse through the help to learn more about the different options.
Select your profiling mode and click the right arrow.
Easy
Advanced

Figure 2-7: Startup screen of Eye-One Match: Select the monitor to profile

2. Select the type of monitor you intend to calibrate (LCD, CRT, or Laptop), then Click to continue.
3. The first task is to calibrate the sensor (not your monitor). Follow the instructions given on the screen. (Help will provide you with additional information.)
4. Select your target calibration settings. We recommend these values:



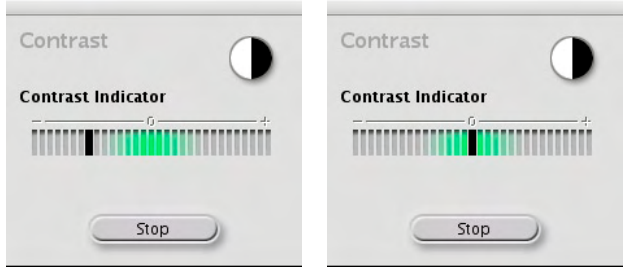
◂ *Figure 2-8: Recommended settings for your monitor calibration*

will take you to the next step.

5. Attach the sensor to your monitor using either the suction-cup (if you are calibrating a CRT) or by attaching the lead weights to your sensor cable and letting them dangle on the backside of the monitor. If you're calibrating an LCD you may have to tilt the monitor backward a bit, so that the sensor lies flat on the screen.

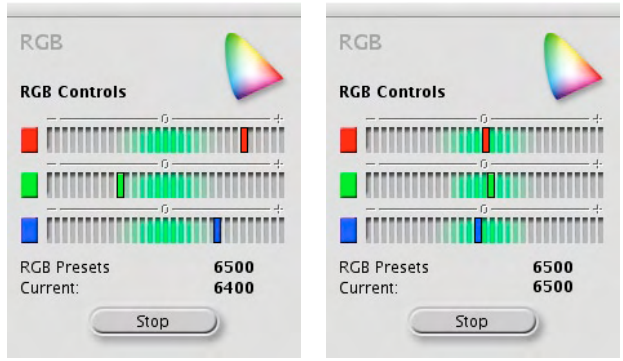
◂ *Figure 2-9: Eye-One Display colorimeter*

6. Begin the calibration phase using the controls on your monitor, if your monitor has them. (Skip this step if you are calibrating a laptop or LCD without controls and continue with step 8). You will set the contrast control to maximum and then slowly reduce it until the green arrow resembles the black one. Don't worry; Eye-One Match will guide you through this calibration.



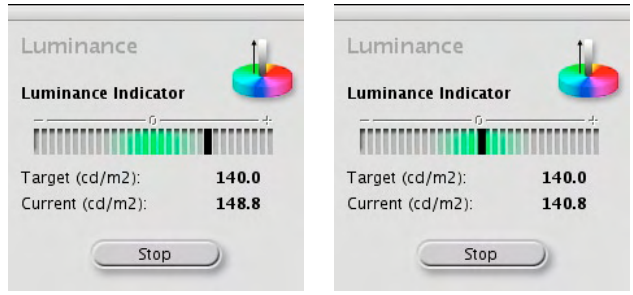
◂ *Figure 2-10: Use your monitor dial to bring the contrast marker near the zero value.*

7. Press Start to have EOM begin measuring the contrast values, then Stop and ▶ to begin calibration of the RGB controls. This step will set the control dials so that the monitor's white point is set close to the intended color temperature (6500 or 5000 Kelvin). This may be achieved either by adjusting an OSD (Online Screen Display) setting on the monitor, or by setting the monitor's R-, G- and B-controls, if any. In this step, all three colored bars should be in the green area for optimal calibration. (The Eye-One Match screen will give you useful feedback.)



◀ *Figure 2-11: If your monitor has RGB controls you should try to set your target white point.*

Next, set luminance using your monitor's brightness controls.



◀ *Figure2-12: Set the luminance using your brightness control of the monitor to a target value of 120–150 cd/m^2.*

8. This finishes the calibration phase, and Eye-One Match will start the actual characterization. It will display a number of color patches and measure their values (which should take about five minutes). You won't need to do anything while this process runs.

9. Once the characterization is finished, Eye-One Match will display the values used and display a diagram of the resulting color space (see figure 2-13 at page 2-22).

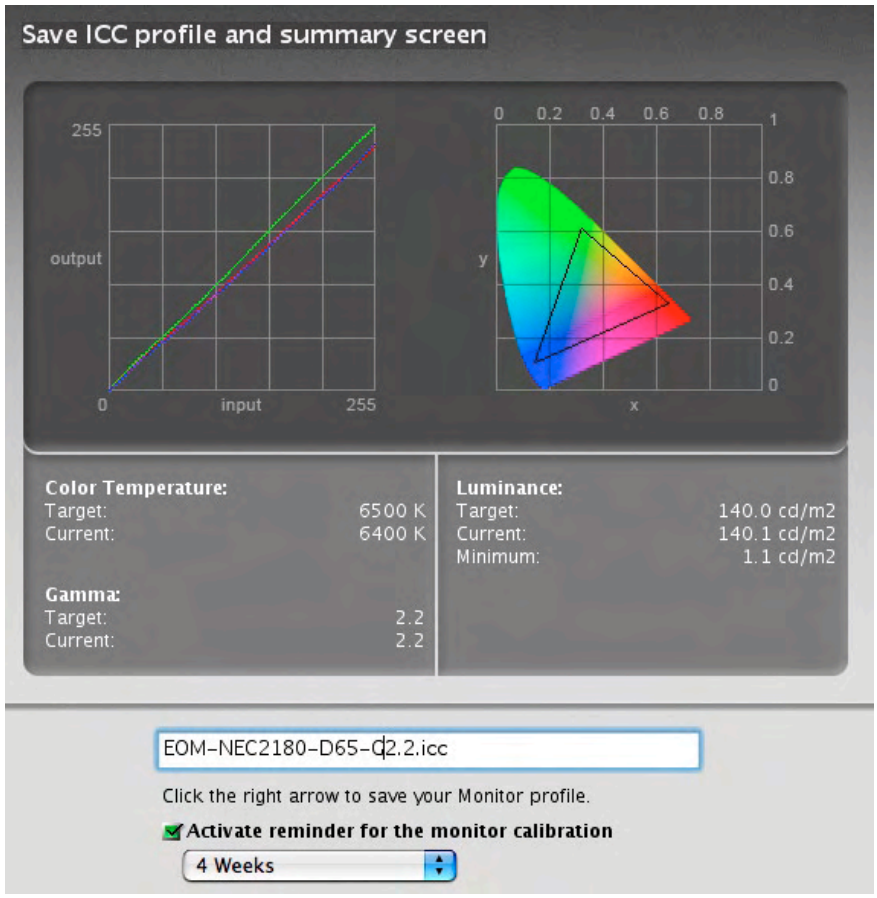


Figure 2-13: When finished, EOM shows the profiling values and the monitor color space. Enter a descriptive profile name.

EOM will also prompt you for a profile name. Choose a descriptive name that reflects the tool used, the make of the monitor, as well as the values used. For example, if your are using EOM to calibrate an NEC 2180 monitor with X values, a suggested name might be "EOM-NEC2180-D65-G2.2".

Eye-One Match will save the ICC profile to the appropriate folder (depending on your operating system), and will immediately make it the active and default monitor profile. Running Windows and having Adobe Gamma installed, you should move Adobe Gamma out of your start folder to prevent it interfering with the correct loading of the new monitor profile when Windows starts up.

Once you have completed these profiling steps, do not change any monitor settings without re-calibrating. You should plan to re-calibrate your monitor about once a month.

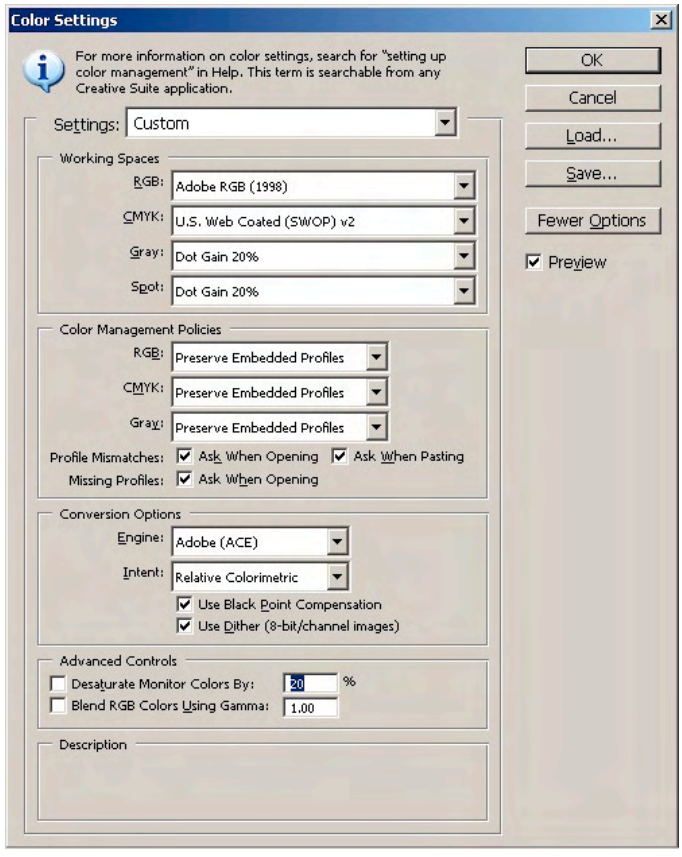
2.4 Photoshop color and monitor profile settings

Before beginning to work with Photoshop, set up the program up with your personal color management preferences. The way color settings are made is similar with all Adobe applications since Adobe Creative Suite 1 (CS1). When using CS2, you may use centralized color settings. These settings will be used (by default) by all other CS2 applications, as well. With CS2, the settings may be done in Bridge.

Photoshop probably offers the most advanced color management support in any application. For that reason, its color settings show many different options and parameters.

To begin setting your color management preferences, select Edit ▸ Color Settings to open the color setting dialog.

Figure 2-10 shows how we set up the "Color Settings" in Photoshop (the most relevant settings are marked).



◂ *Figure 2-14: Photoshop color settings*

Note: We ignore settings for CMYK and Gray here as we only cover RGB color setup in our workflow. If you live in Europe, your CMYK

Setting should either be *Euroscale Coated* or *ISO Coated*. If you are mainly preparing your images for prepress, use ECI-RGB as your default RGB color space, in which case your settings might look like this:

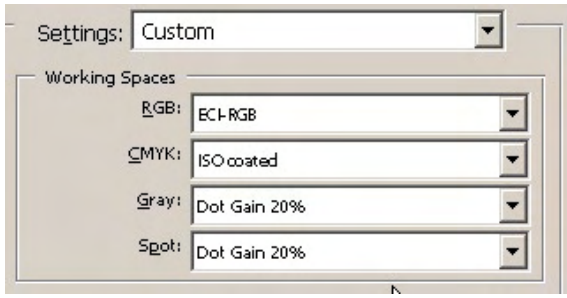


Figure 2-15: Recommended working spaces for prepress work in Europe

Photoshop is not particularly intuitive when it comes to finding the monitor profile in use. To determine which profile is in use, select Edit ▸ Color Settings and use the RGB drop-down list to select working spaces and scroll (usually up) until you find the entry *Monitor RGB* (Figure 2-x shows Sony_LCD_Std_D65). The entry you see indicates the monitor profile in use.

Note: Close the Color Settings dialog box by clicking Cancel in order to avoid changing your working space settings. Your monitor profile should never be your work space!

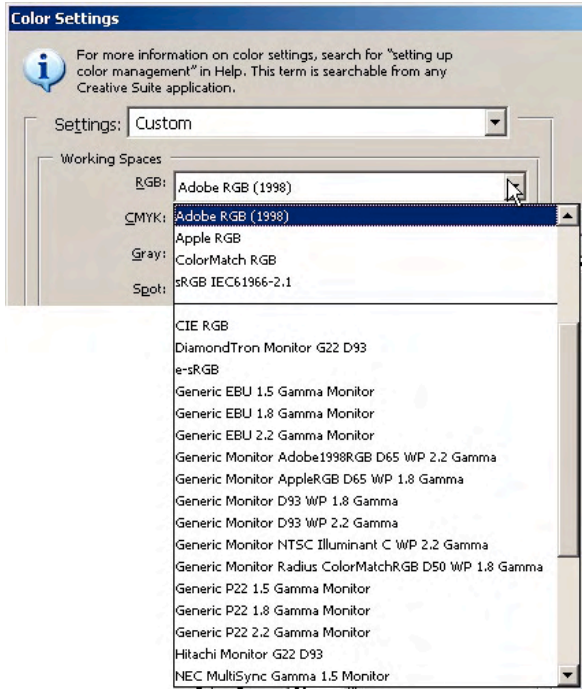

Color Settings
For more information on color settings, search for "setting up color management" in Help. This term is searchable from any Creative Suite application.
Settings: Custom
Working Spaces
RGB: Adobe RGB (1998)
CMYK:
Gray:
Spot:
Adobe RGB (1998)
Apple RGB
ColorMatch RGB
sRGB IEC61966-2.1
CIE RGB
DiamondTron Monitor G22 D93
e-sRGB
Generic EBU 1.5 Gamma Monitor
Generic EBU 1.8 Gamma Monitor
Generic EBU 2.2 Gamma Monitor
Generic Monitor Adobe1998RGB D65 WP 2.2 Gamma
Generic Monitor AppleRGB D65 WP 1.8 Gamma
Generic Monitor D93 WP 1.8 Gamma
Generic Monitor D93 WP 2.2 Gamma
Generic Monitor NTSC Illuminant C WP 2.2 Gamma
Generic Monitor Radius ColorMatchRGB D50 WP 1.8 Gamma
Generic P22 1.5 Gamma Monitor
Generic P22 1.8 Gamma Monitor
Generic P22 2.2 Gamma Monitor
Hitachi Monitor G22 D93
NEC MultiSync Gamma 1.5 Monitor

Figure 2-16: Finding the Monitor Profile in Photoshop

Chapter 3

Basic RAW workflow

Camera: Canon 350D (Rebel XT)

Here, we want to outline the basic workflow steps and tasks of a digital RAW negative workflow. The RAW converters featured in the next chapter will perform most of these tasks outlined here.

As an overview, here is a list of the main steps:

- Handling the camera in the field using RAW file photographs
- Transferring images to the computer
- Setting up digital workflow tools
- Browsing and evaluating RAW images

- Essential image corrections
  - White balance (WB)
  - Improving tonality
  - Getting better colors
- Advanced image corrections
- Advanced workflow helpers

In following chapters we will show how these steps can be handled by the various RAW converters we cover, starting with Adobe Camera Raw.

3.1 Setup the camera for RAW file photographs

Set your camera to RAW mode

This is a basic step as you merely follow your camera manual and set the camera to RAW. Some cameras allow use of both RAW and JPEG simultaneously. We don't always recommend this as it uses more memory space on the card. Of course, there are instances when it may make good sense to do so, e.g., when you need to have the image available as JPEG quickly, without spending time with image optimization using the RAW converter. For dedicated images, you may then still go back to your RAW file, getting the most from it.

Exposure, Exposure, Exposure

There are really not a lot of differences from traditional photography. A better exposure is the ticket to a good final result. Raw file processing may allow you to get good results from not-so-perfect exposure, but this should not be taken as an excuse for sloppy exposures.

A good exposure sounds so easy, but it is not. What you want is:

- No blown highlights
- No underexposed images
- No noisy and dark shadows

The good news is that there is an instrument in digital cameras that allows you to evaluate exposure instantly after you take the photo: It is the histogram.

Optimize exposure using your camera's histogram

In the field, the main difference between using a film and a digital camera is the LCD on the back of the digital camera giving you the ability to evaluate an image right after exposure. You might think that viewing your pictures on that tiny LCD is a major benefit in going digital. Yes, if you try hard, you can check sharpness by zooming in on the image. The main advantage of this LCD for me, however, is to check exposure in my last photo.

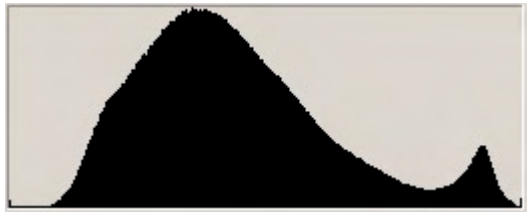
Correct exposure is the key to taking quality images. This did not change from film to digital. In some ways, over-exposure becomes more problematic in digital as the sensors tends to clip data beyond a certain threshold. This equates to: Never overexpose your photos. In this case, the highlights may be lost and recovery is not possible (though there are some techniques to estimate lost highlight).

There is help which only the digital cameras can provide: The cameras provide a way to view the result of the last photograph taken and show a histogram of the grayscale values from 0 (black) to 255 (white).

Here are four histograms examples (created in Photoshop) that show different characteristics and show histogram basics.

◂ *Figure 3-1: Histogram 1 – indicating strong overexposure*

Highlights (right side of the histogram) have been lost. This shot would be a candidate for deletion in all but a few rare cases. Some might recommend to "burn" the photo in Photoshop. Still that is faking details in the highlights that are not actually there. Histogram 2: Histogram indicating potential over-exposure



◂ *Figure 3-2: Histogram 2*

There is only a small spike in the highlights and it very much depends on the photo whether this might be a problem or not. If the spike represents a real pure white or an unimportant specular highlight then this photo may be OK. Otherwise, you are in trouble.

In such cases, if the camera has the ability to indicate overexposed areas, we recommend having a glance at the camera's LCD preview with the highlight/overexposure indicator enabled.

Figure 3-3: Histogram 3 – indicates good exposure

Here the highlights are OK. You lost a bit of the dynamic range in the highlight area but Photoshop can correct for this. You should endeavor to get histograms similar to this. In principle, it is best to get as close as possible to the right without actually touching it.

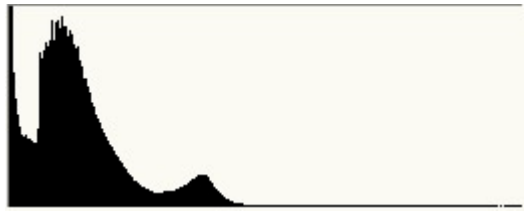


Figure 3-4: Histogram 4 – indicates strong under exposure

Here the data in the shadows are lost. This is not the only problem since digital cameras show much more noise in the shadows. Once this image is corrected, extended noise would show up even in the midrange.

"Expose to the right" rule

From the above we learned that the ideal histogram should:

- Not indicate any over-exposure or missing highlights
- Not under-expose because you may lose shadow details, and more importantly, get more noise

In conclusion, the perfect digital exposure is as far to the right as possible without over-exposure. Unfortunately the reality is not that simple.

The overall shape of the histogram does not matter at all, as it merely reflects the tonal distribution of the scene you photographed.

Read the next section and you will understand why it is safer to slightly under-expose than risk highlight clipping. This is especially true as some histograms are hard to read outdoors in bright daylight.

Color channel clipping

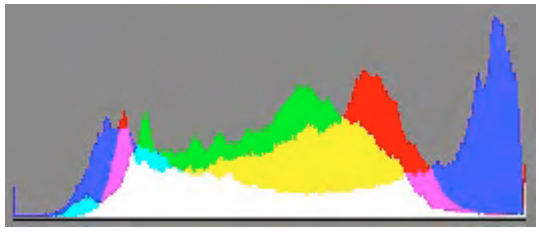
We mentioned that most histograms in cameras show the histogram as grayscale levels. But as we are dealing with color images, we have, in reality, histograms of all three RGB channels.

Some clipping can happen just in one or two color channels, which might not display in the luminance histogram.

Here is an example from the Canon 10D demonstrating typical problems with saturated colors. Blue, orange and yellow flowers are good candidates, and it is safer not to use up the full exposure headroom to the right.

Figure 3.5: Image with clipping in the blue channel

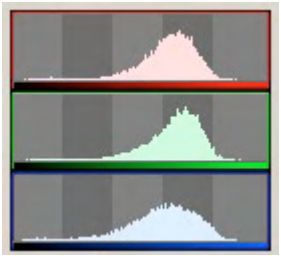
The histogram in Camera Raw 2.2 clearly shows the challenge in the blue channel.



◂ *Figure 3-6: Camera Raw 2.0 histogram of image 3-5.*

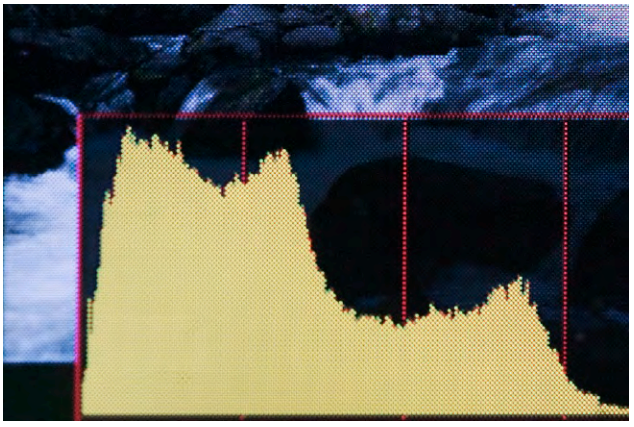
This overexposure in the blue channel was not shown by the camera histogram as it averages all three channels (most often, they use a so-called luminance histogram, where green gets valued higher than red/blue).

In this difficult situation, it would be very helpful if you also had histograms for the three-color channels. The only cameras we know providing this are the Fuji S2 and the new Canon 1D Mark II. The latter provides a histogram like this one:



◂ *Figure 3-7:* The "after" histogram.

Most cameras allow you to inspect the histogram as part of the instant preview. Here is an example from the Nikon D70:



◂ *Figure 3-8:* Histogram from a Nikon D70.

Of course, the "after" histogram only helps if you can repeat the shot. Fortunately, when doing nature photography, this is frequently the case except for photographing birds and other wildlife. We check the histogram constantly. Once the exposure is right and the light does not change, it is necessary to only check the histogram occasionally.

The "before/live" histogram

The ideal would be to display a live histogram and use it instead of the camera meter. For digicams, this dream has come to be actuality. The new 8MP Konica Minolta DiMAGE, Sony F828 and Olympus 8080 all sport live histograms.

Figure 3-9: Shot form the LCD of the A2.

Implementing live histograms in digital SLRs is problematic as the viewing mirror hides the sensor. One thing for sure: Refined versions of live histograms are the way to go.

Do we really need the histogram?

What we actually need from the histogram is the information about under/over exposure. If this information can be presented by other means, then the histogram may become obsolete. But, for now, the histogram is your ticket to a better exposure.

Correct white balance (WB) for optimal color quality

The key to correct color is getting the white balance correct, and that depends on the light source or sources illuminating the photographed scene.

When using film, the choice of film type or the filters used to compensate for different lighting conditions (indoor, sun, cloudy, shade, flash, etc.) all influence the white balance.

If you use only RAW file formats, WB can be corrected later. For fine art photography, true color isn't what really matters (would

someone use Velvia™ for that?) Most people are more interested in the subjective 'correct' (i.e. pleasing) WB.

Digital SLRs allows you to measure the right WB (custom WB) at the time you photograph. This might be optimal, but is not always easy in the field (nature). Therefore, set the WB to "auto" for all cameras and adjust the WB later in the RAW converter. A preferred practice is to photograph a gray card (or even better, a Macbeth ColorChecker) in the same light as the following photos and use this shot later for the correct WB correction.

Correcting WB (and color in general) can be very tricky, highly subjective and requires a lot of experience. With practice, you will improve.

Additionally, an observation: Judging colors is very much a function of mood. Sometimes colder colors (more blue) are viewed, and, in that case, you may want more warmth (more yellow). Such experiments can amount to a lot of time optimizing images.

If occasionally you feel lost, don't worry. You are not alone!

Understand objective and subjective white balance

There is a significant difference between 'pleasing' and 'correct' color. Only in a relatively few photographic disciplines are you concerned about the correct color. This may be the case when photographing fabrics or, perhaps, catalog shots. Otherwise, usually aim for pleasing colors. The most heated discussions occur over what constitutes a good skin tone. Even here exist many cultural differences.

Begin with a white balance you prefer, optimize the contrast and change colors selectively only if there are major issues. Some shots might need skin tone correction, while in others, the shade of a boring blue sky.

Adjust your camera's sensitivity: selecting the right ISO

Today's digital cameras allow changing the ISO value on the fly by simply dialing in a new value. This is a huge plus for digital as you can change ISO speed on a picture-by-picture basis.

A low ISO normally results in lower noise (better image quality) and a high ISO means higher noise (lower image quality). Noise can show up in many different ways. If a camera shows noise-like grains

of "salt and pepper" then this is very positive, as we all are accustomed to this grain from our film-based experience.

Note: Stay at low ISO whenever possible and use a tripod!

If you need to use a higher ISO, try to improve such photos by using top-class noise removal tools (see *Noise reduction* at chapter 7).

3.2 Camera to computer: enter the digital darkroom

Manage your image storage

Once back from the field with memory cards and/or digital wallets filled, it is time to transfer these files to your computer.

Be aware that this requires a lot of disk space. Converting images to 16-bit TIFFs makes even more demands on disk space.

You might be thinking in Gigabytes and soon in Terabytes. We currently have about 1,000 GB of storage in our network (to accommodate organization and duplicates). A reasonable starting point is 80 GB at minimum then adding external Firewire drives as backup (perhaps start with 160 GB).

Computer transfer and organizing your photos

Most cameras today come with either a USB or Firewire interface. Many also use these interfaces to transfer files to a computer. We personally choose not use this feature, as it offers little help if you have multiple memory cards and/or digital wallets. Nor do we believe cameras themselves are the most robust CF card readers.

We chose a USB 2.0 card reader installed on our main PC (same is available for Macs) then proceeded by copying our images from a day's shoot to a new directory in our "inbox" folder.

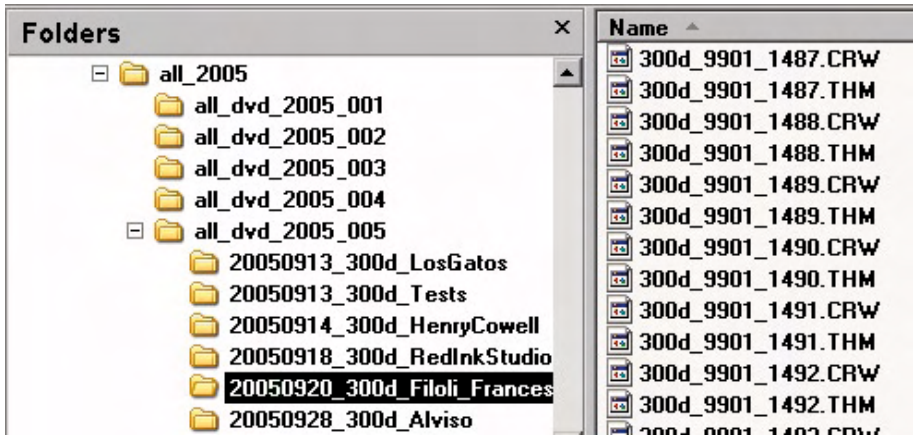


Figure 3-10: Inbox folders

Since several different cameras are frequently used, the goal is to give every image a different name (even when using two cameras of the same type).

The following explains the file hierarchy:

- **all_2005:** all RAW files from all cameras for 2005 go here
- **all_dvd_2005_001:** this is the first DVD set (or use CDs) for 2005. It is suggested you create a new folder when one's content exceeds about 4 GB (data to fit on one DVD or 600 MB for a single CD)
- **20050913_300d_LosGatos:** a folder from a single photo session in Los Gatos (actually better to name it "Los_Gatos" as some archival tools filter out names.
- The name also contains the date yyyymmdd for easier sorting
- **300d:** for information on the camera used
- Subject: (sometime followed by "_01" or "_0x" if more than one card was used that day.

All image files are renamed to: 300d_nnnn_mmm where:

- 300d describes the camera type
- *nnnn* is a sequence number (starting at 0000) and incremented. Why do this? You may use two 300D cameras but still all images deserve a unique filename. Also, when 9999 is reached, the camera restarts at 0001. Sequence numbers allow unique file names.

If we later work on a file in Photoshop, the result is saved as a master TIFF file. The file name will keep its original "300d_nnnn_mmm" file name, and can be appended with more descriptive text:

An example:
- **Original:** 300d_0001_1256
- **Derived:** 300d_0001_1256_Los_Gatos_Bear_Cafe

In doing this, every file is linked by its original file name to the RAW file in the archives.

Renaming

As described above, after copying files to a hard disk, files are renamed to ensure their names will be unique. A free PC utility called "Rname-it" is used (you can download it from our web site at [38]). Several others programs are available, e.g. Renamer4Mac ([39]) for Mac OS X.

The Photoshop CS File Browser and Capture One also allow renaming your files. We find Rname-it suitable for our use. A file name can contain a prefix describing the digital cameras used with, for instance, a name like "1Ds_0000_". We use software called Downloader Pro (PC only, see [41]).

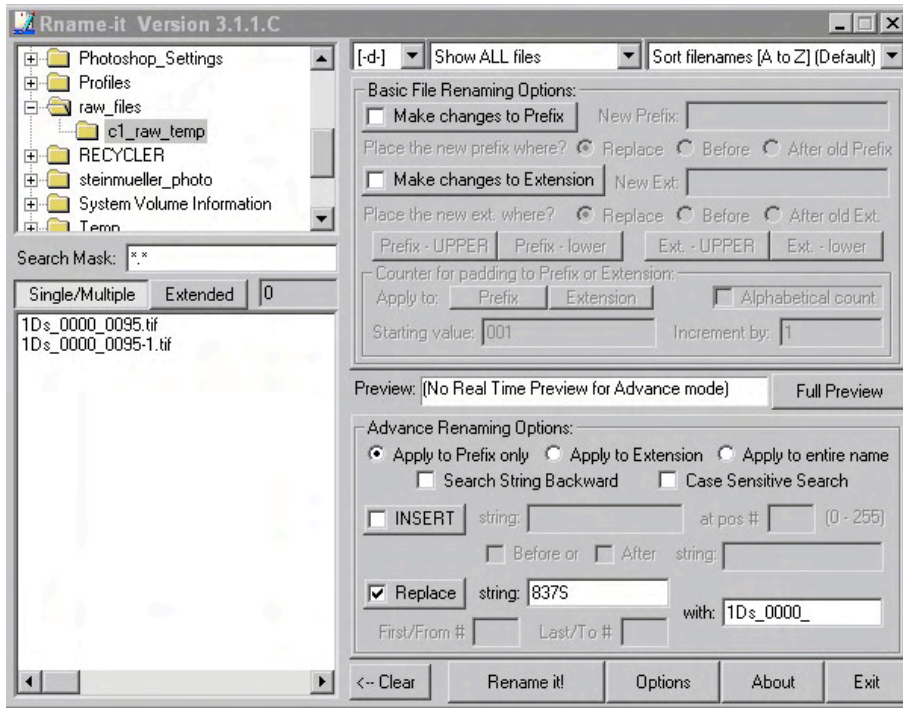


Figure 3-11: Freeware PC renaming tool "Rname-it"

Securing your valuable photos: Backup

After transferring the images, it is strongly advised to backup these files to a physically different hard disk or to CD/DVD. After that, it is safe to erase the images from your memory card or possibly reformat the CF cards or Microdrives.

Tip: Backup, Backup, Backup

- Make backup CDs or DVDs
- Use two different CD/DVD brands if you make two copies. If a CD from manufacturer A fails there is a chance that additional copies may be faulty, as well.
- Store each copy in a different location
- Once you have stored your files on a disk drive, you can confidently enter the digital darkroom and begin to work on your images.

Note: Infrequently, your Microdrive or Compact Flash card becomes corrupt. Do not panic! **G**et **Photorescue** (for more information consult our web site [3]) There are several other programs to help recover images from corrupted file systems or memory cards.

3.3 Setting up your digital darkroom

This step is required only when a new RAW converter is installed or possibly if you change options.

- Setting up the cache folder: Most modern RAW converters use a cache to make unnecessary the need to create previews repeatedly while working on a set of images.
- Choosing the working space you will use (mainly ProPhoto RGB for 16-bit only, Adobe RGB or sRGB).
- Select either 8- or 16-bit TIFFs or 8-bit JPEGs (we do not recommend the latter).
- Some RAW converters allow selecting the per-image-settings are storage area.
- Which application (if any) to launch after converting an image.

3.4 Browse and evaluate your RAW files

It is quite important for every photographer to inspect both new and older images. Particularly as you upload your work to a computer, you want to analyze new images as quickly as possible, decide which to retain and which to delete, and begin working on the 'keepers.'

A small thumbnail, as provided on older file browsers, is not usually good enough to determine whether the following image criteria are met. Advisable also is to preview RAW files on a digital light table which is best integrated with a complete RAW converter. The critical points to look for when inspecting your RAW files are:

- Is the composition satisfactory?
- Is critical sharpness achieved?
- Is the exposure OK? Here we need to see a histogram.
- Quality of colors. This step usually requires a correction of white balance.
- Flagging files and/or setting priorities.
- Basic rotation (in 90-degrees increments).
- The deletion workflow: 'Delete' sounds simple, right? In fact, it is one of the most dangerous operations. When you have deleted a valuable image you know you have a problem. If you keep all questionable images, you'll need lots of disk space, having to view those images again and again. An effective delete workflow is a two-step process: First, mark for deletion, revisit the marked images and then finally delete them. The RawShooter solution is simple, yet elegant. ACR 3.0 and Capture One may provide helpful solutions, as well.
- Ad hoc corrections, where the settings stick with the image: This implies that in previewing an image you can correct white balance and exposure on the fly. These settings remain when you revisit RAW files later on. All RAW converters covered fulfill this criterion.
- Ad hoc slide show: (in Bridge and RawShooter)

All the major RAW converters featured in this book are very capable browsers and inspectors.

3.5 Essential image corrections

White balance (WB)

A key part in getting the correct colors in your images is setting the WB correctly.

White balance (WB) – Essential

Good white balance support is crucial for any useful RAW converter. There are a couple of white balance correction techniques:

- Gray balance by clicking on a neutral spot in the photo
- White balance correction controls
  - Color temperature and tint

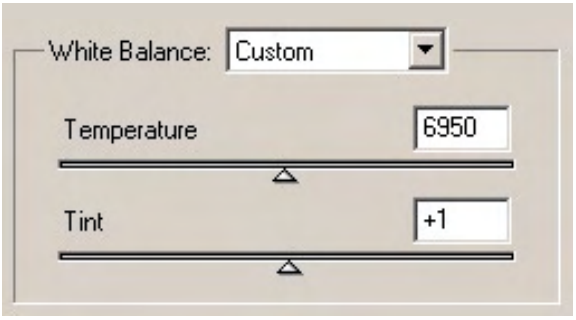


Figure 3-12: White balance in Adobe Camera Raw

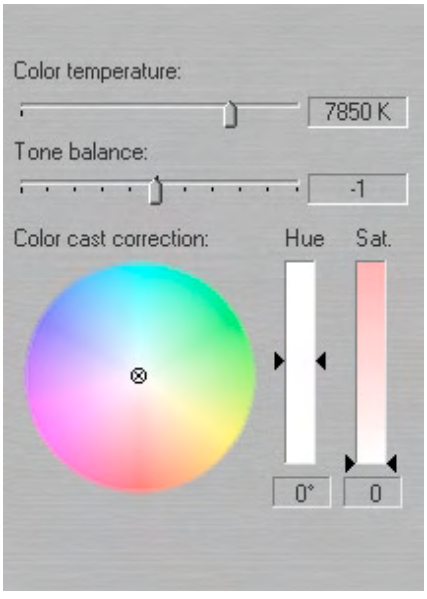


Figure 3-13: White balance in Capture One

  - Warmer/colder control

Figure 3-14: White balance Colder/Warmer interface in RawShooter.

  - Presets (daylight, shade, tungsten, ..)

- White balance as shot in camera
- Auto white balance

Correct white balance support is also not a trivial task for any RAW converter. We expect that today's capable RAW converter can preview WB correction in real-time.

Note: Some RAW converters have a single color temperature slider (measured in Kelvin). These RAW converters oversimplify the situation of color cast. In many lighting conditions, especially outdoors, color cast cannot be corrected with a single slider.

White balance samples

This example shows how to use the white balance settings of your RAW converter.

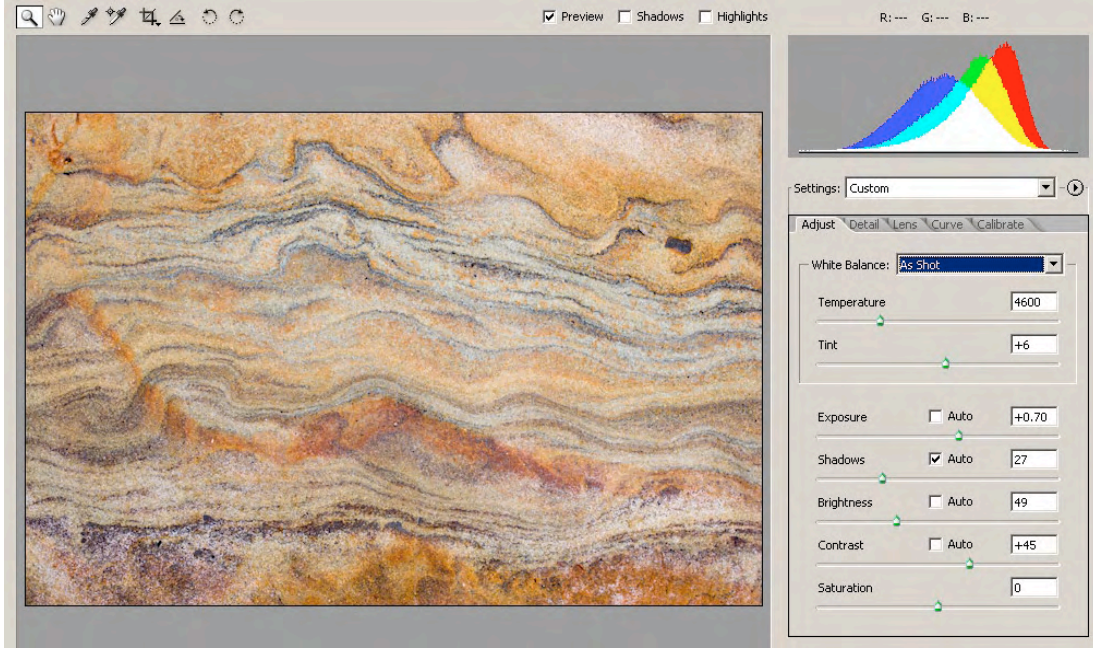


Figure 3-15: Image with WB "as shot"

The camera records WB settings, and these are called "as shot." Such settings can be achieved with the following camera settings:

- "auto": means that the camera attempts to make a good guess. This can be a decent start, sometimes.
- Camera presets (like daylight, flash, tungsten …): Use this option only if you know the light source for sure.
- Custom white balance: where the white balance is measured in the camera. Useful with mixed light or if the light stays constant for a period of time (e.g. sports photography).

These next samples demonstrate how small changes in color temperature can have a strong impact on color balance.

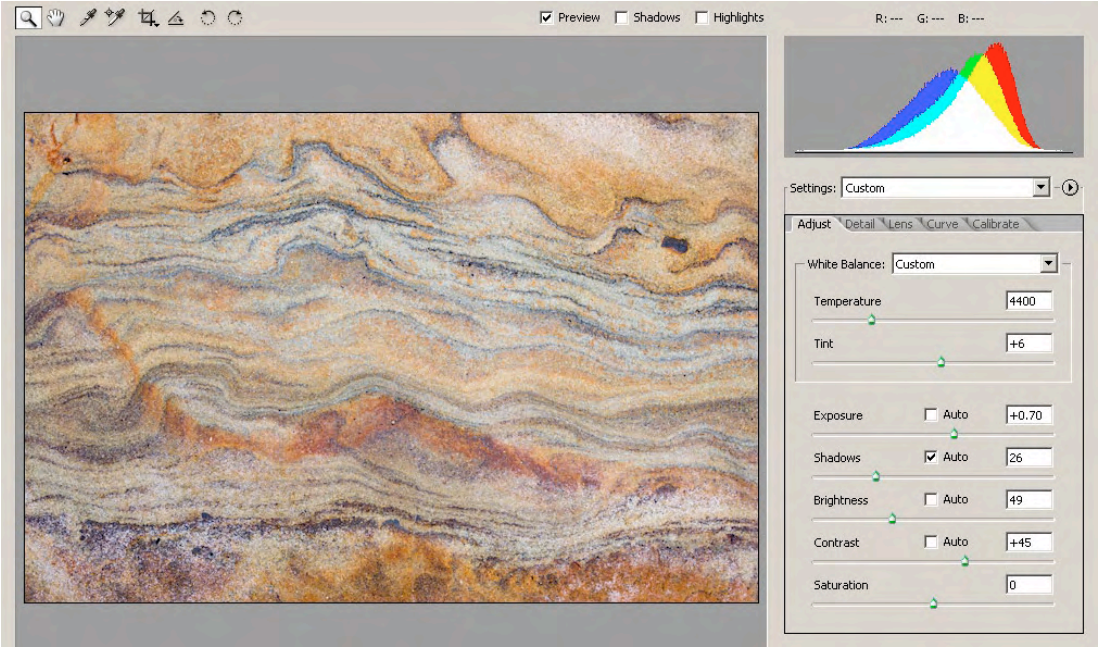


Figure 3-16: Color temperature set to a lower value

Note: Some may be confused by the notion of "higher color temperature" believing it tends to be bluer or "colder." Colder in this sense makes an image look subjectively colder and more bluish.

The above sample displays slightly "colder" because we assumed it was shot at a lower color temperature.

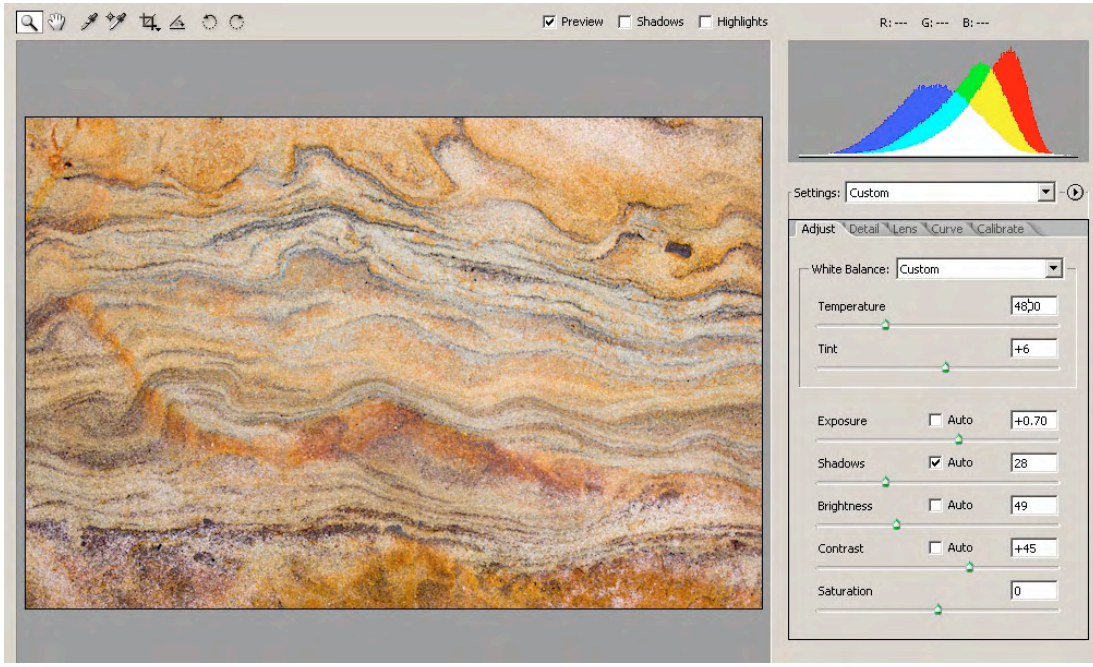


Figure 3-17: Color temperature set to a higher value

The above sample displays slightly "warmer" because we assumed it was shot at a higher color temperature.

Tonality

Exposure (white point), shadow point, contrast and brightness

A key factor in getting a correct image is creating a good tonality. Looking at B&W photos you realize that tonality is the only thing you care about:

- How smooth are the tonal transitions
- Contrast
- Highlights
- Shadows
- White point (brightest point)
- Black point (darkest point)

With color images it is more difficult to judge optimal tonality. Yet, the same criteria hold for color photos. Image tonality is influenced by the following factors:

Exposure, Contrast & Brightness

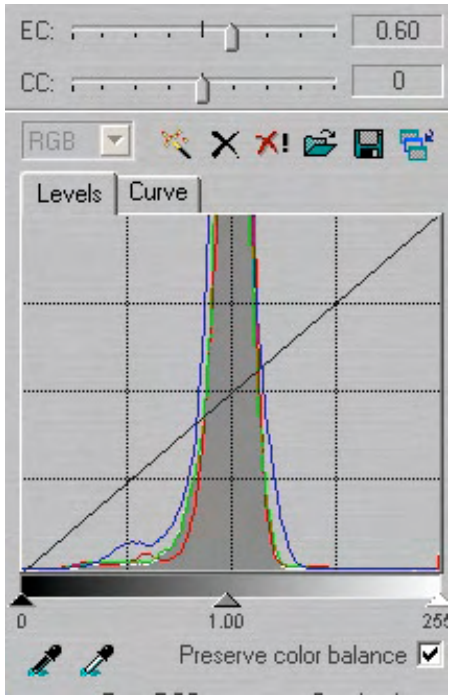


Figure 3-18: Tonality correction in Capture One

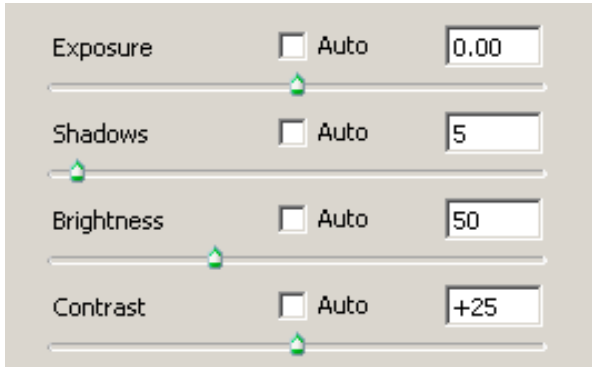


Figure 3-19: Tonality controls in Adobe Camera Raw

Proper exposure compensation is essential. Tools should include a histogram or equivalent with under- and over-exposure indicators (Watch also for over-exposure in any single RGB channel). While under-exposed shots can often be corrected to one or two stops without too much loss of quality, over-exposure is very difficult (or impossible) to correct. Once values are clipped in the highlights (this may occur per RGB channel) there is rarely any way to correct it. Control exposure to avoid over-exposure at all times.

Adaptive tonality controls

In brightening up shadows, normal curve or levels controls are not really effective. You need tools that work adaptively. This means that contrast is corrected locally in proportion to the area in which the pixels reside.

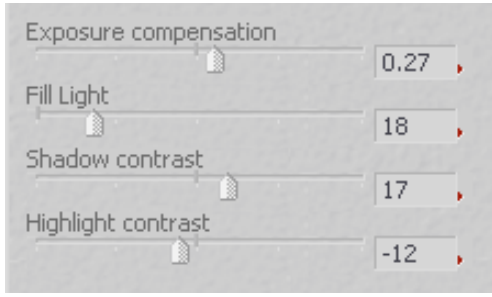


Figure 3-20: RawShooter controls

As Photoshop does with its Shadow/Highlight function, RawShooter uses an adaptive way to improve shadows called "Fill Light".

Tonality sample #1

Let's begin with a photo shot at very low contrast.

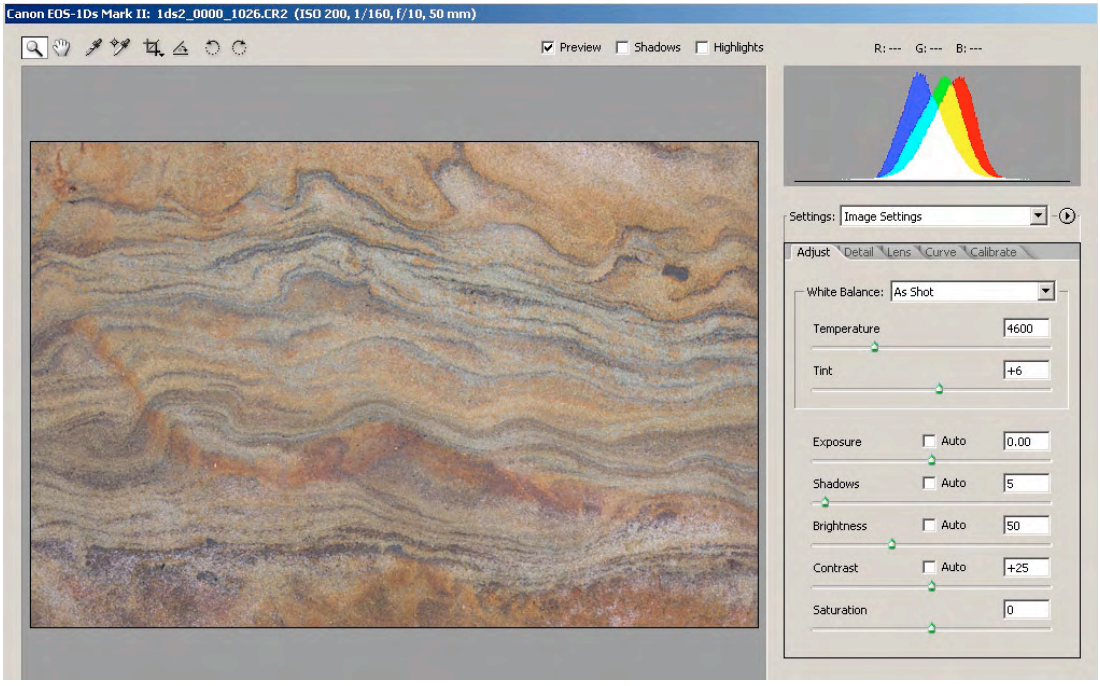


Figure 3-21: Rock colors photographed at low light

If you are able to recall the original scene when shooting took placer, the representation in figure 3-21 may be quite accurate and it's color correct. But, some flat images look too truthful or even dull. All this image needs is more contrast to bring it to life.

The histogram shows what this image is lacking:

- There are almost no dark or black tones
- Nor are there real bright tones either

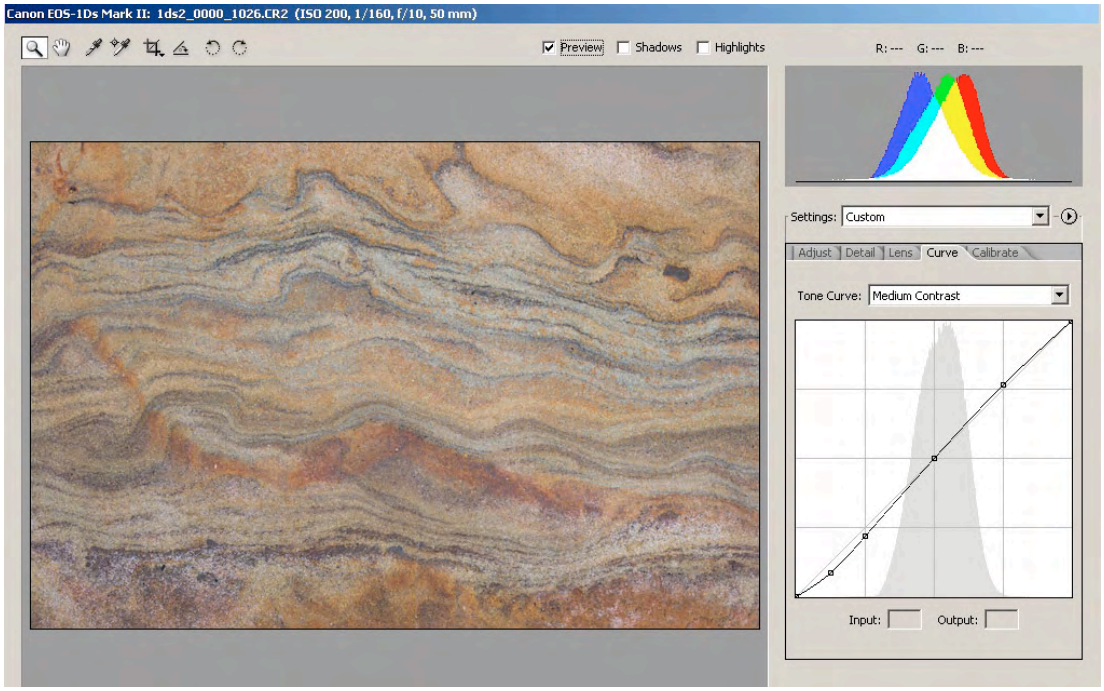


Figure 3-22: Improved shadows with ACR curves

Although the curve control improves shadows some, the image is still unacceptable.

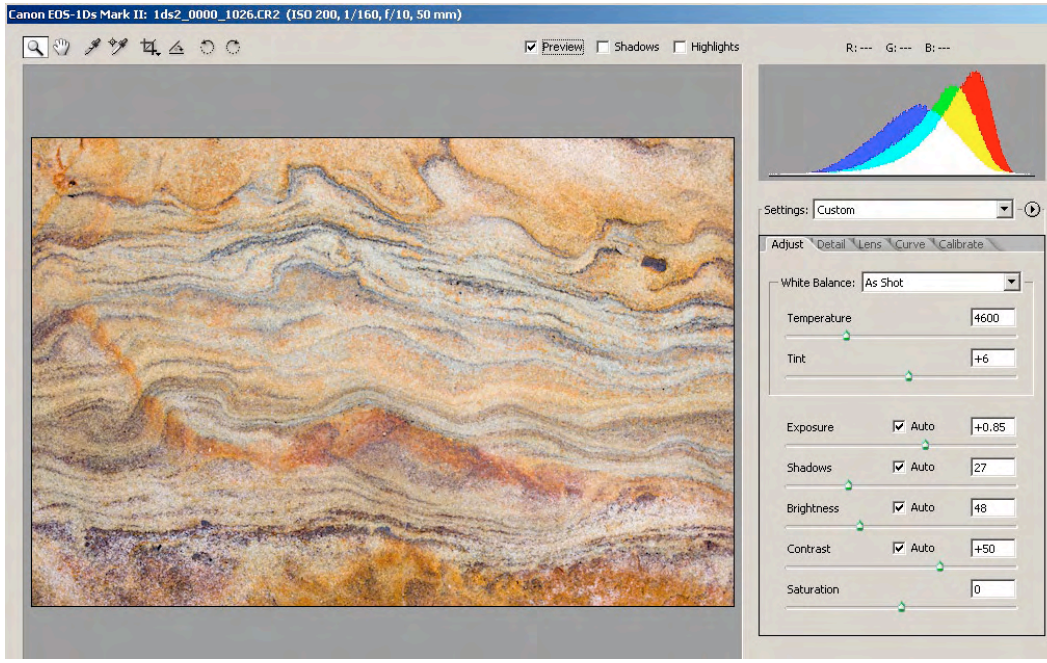


Figure 3-23: Using the ACR "auto" setting

Using ACR "auto" settings lets the image "pop" – but possibly too much so.

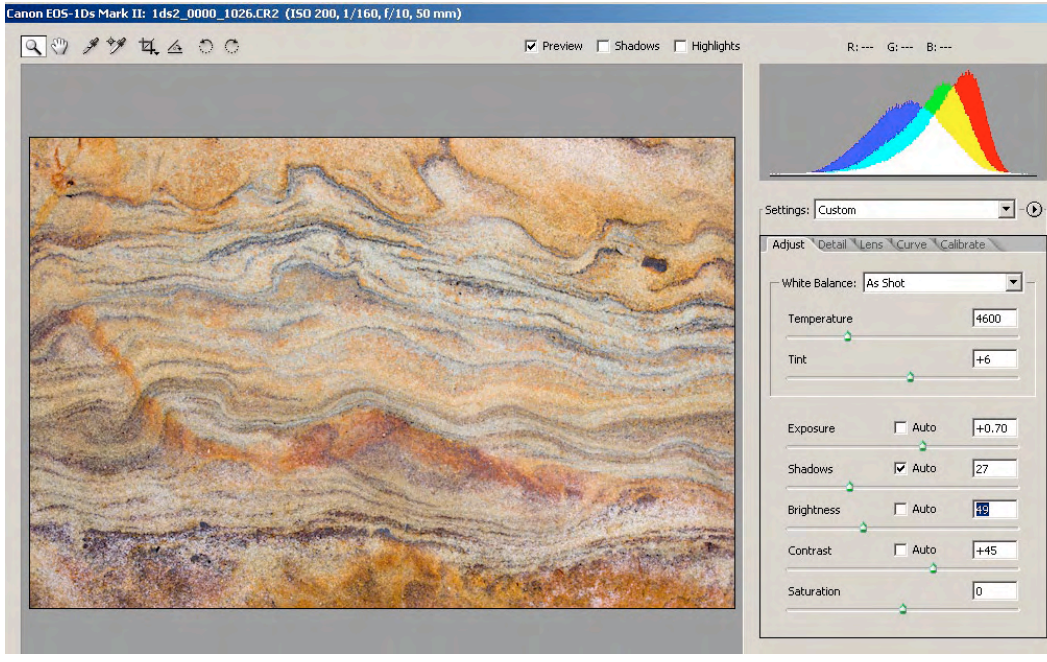


Figure 3-24: The final version with some tweaking based on "auto"

It is unwise to correct tones only referring to the histogram. Best you judge it visually, as well.

Conclusion: Low contrast images may be a suitable starting point, since RAW converters do allow you to improve the overall contrast.

Tonality sample #2

Images covering a wide contrast range are much more difficult to correct. Here the classic Levels and Curves tools show limitations.

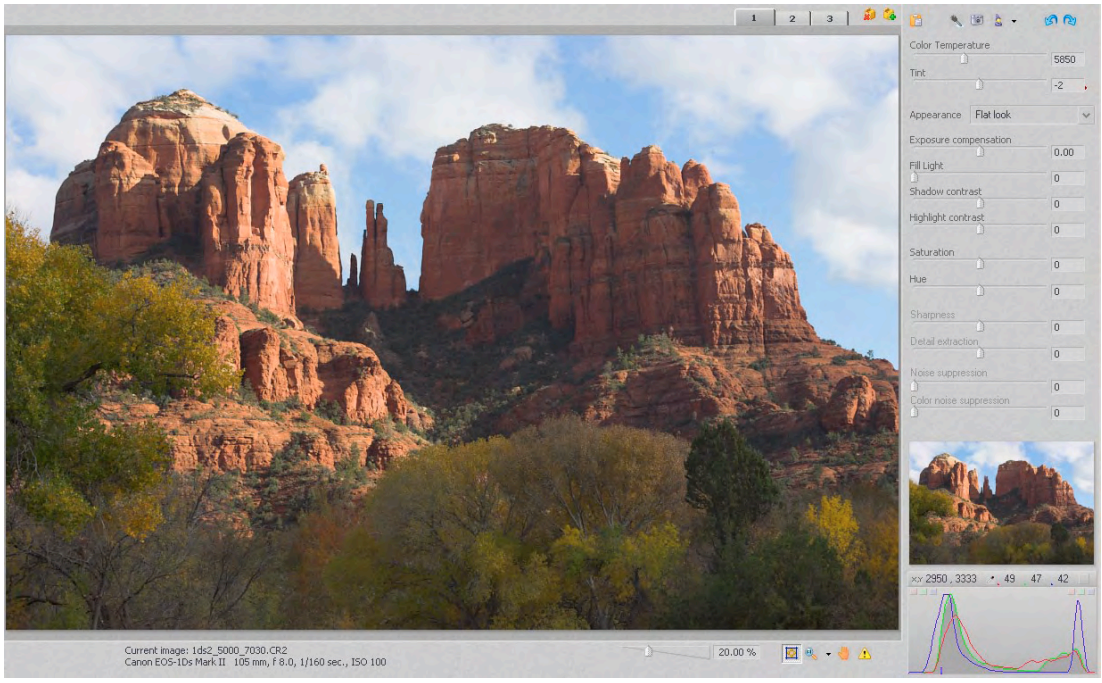


Figure 3-25: Scene with strong shadows

Normally, these kinds of images are candidates for a Shadows/Highlight tool treatment in Photoshop CS. The RawShooter converter, however, permits adaptive correction as a part of tonality control at this early stage of RAW conversion.

Finally, manual fine tuning brings out the best results, shown in figure 3-27.

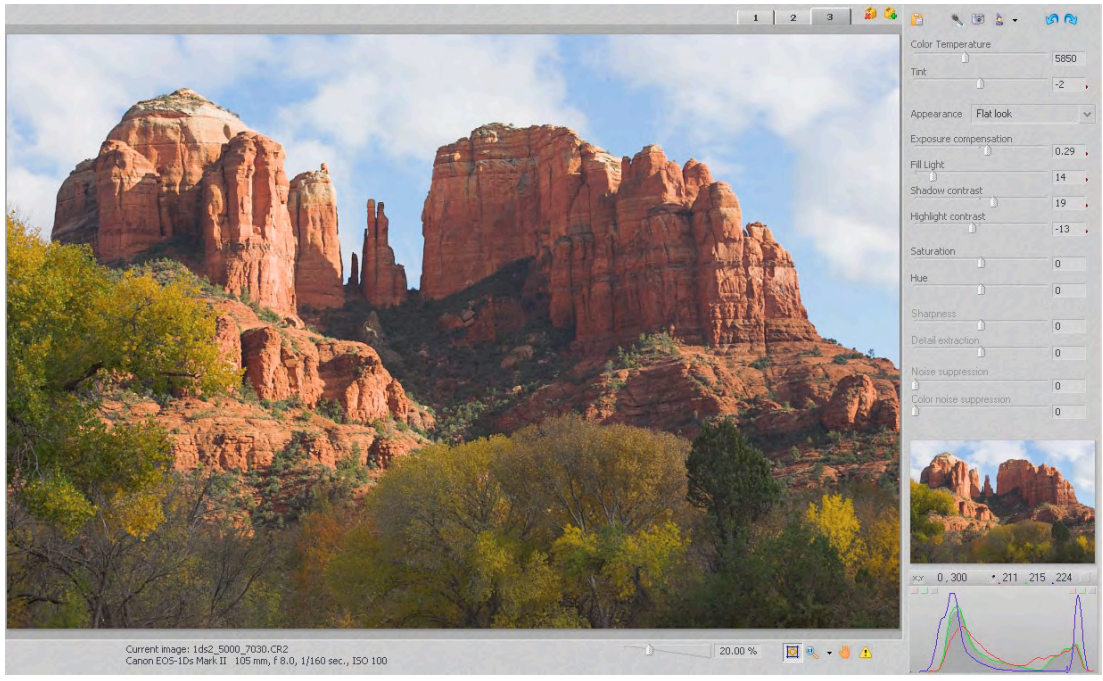


Figure 3-26: RawShooter with "auto" exposure setting

Figure 3-27: Result after careful fine tuning

We are convinced that more RAW converters will provide adaptive tonality control in the future.

Color corrections

The major step towards correct color is getting the white balance right. Then, after you have corrected tonality (with the focus on contrast), your image should be near what you want it to be. But the colors in RAW converters are also influenced by these other factors:

- Camera profiles
- Saturation settings
- Color controls in the RAW converter

All RAW converters we are discussing come with reasonably good camera profiles. Profiles are available on the market, and they may help improve your results.

It is essential to make a distinction between correct and pleasing colors. As mentioned earlier, in only limited areas of photography do you want true and correct colors (i.e., art reproductions, fabrics for catalogs). Most photographers, on the other hand, look for pleasing or even expressive colors. One of the problematic areas is skin tone. In this arena, pleasing colors are highly subjective.

3.6 Advanced image corrections

It is truly amazing how many defects you can find in an image when you start carefully looking. While some RAW converters help correct certain lens deficiencies, in the end you may choose Photoshop to fix those remaining defects. We dedicate a whole chapter on how to deal with all these different defects (see chapter 7).

Here is a list of main defects that must be covered at some point in a workflow:

- Noise (luminance and color noise)
- Sharpening
- Removal of chromatic aberrations (CA)
- Vignetting
- Cropping
- Correcting tilt (so easy to have a shot uneven horizontally)
- Perspective corrections
- Dust removal
- Up-sampling

3.7 Extra workflow support

Here are more features offered by some RAW converters, that may speed up work and make it easier:

- Batch conversion
- Background processing
- Applying settings from one file to other files
- Snapshots of different conversion settings
- Save/restore settings
- Camera default settings
- Undo/redo
- Support for scroll wheels
- Keyboard shortcuts
- RGB value samplers

We go into these when describing how to work with the various RAW converters.

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Chapter 4

Adobe Camera Raw

Camera: Canon 1DS Mk. II

Adobe Camera Raw (ACR for short) is Adobe's RAW converter. Camera Raw version 1 was an optional plug-in to Adobe Photoshop 7, but ACR version 2 is supplied free of charge with Photoshop CS (1) (also called Photoshop 8). There was a substantial jump in functionality with ACR2. Adobe Camera Raw version 3 (ACR 3) is now in its third generation and is probably the most used 3rd party RAW converter. It comes for free with every version of Photoshop CS1/CS2.

New with ACR3 are Auto-corrections and improved batch processing. Additionally, cropping and straightening tools were introduced with this version.

While the file browser was a module in Photoshop 7 then enhanced in Photoshop CS1, with CS2 it becomes a separate utility called *Bridge*, now the universal file browser in all Adobe applications of Creative Suite 2. It provides previews of all kinds of (Adobe) data files. Though Bridge offers several enhancements over the previous file browser of Photoshop CS1, for many uses you may well use the PS CS1 file browser instead of Bridge. Bridge is highly customizable, and in our estimate, the most flexible and most powerful file browser of all those we will deal with in this book. If you do desktop publishing, its full strength will become obvious as you use its close integration with all the Adobe applications, such as Photoshop, Camera Raw, InDesign, Illustrator, Acrobat, GoLive and Version Cue. However, in this book, we focus only on those functions, relevant to Camera Raw, Photoshop and our workflow.

As many readers still use Photoshop CS1 and ACR2.x, we will flag those features (if appropriate) since ACR3 only became available with Photoshop CS2.

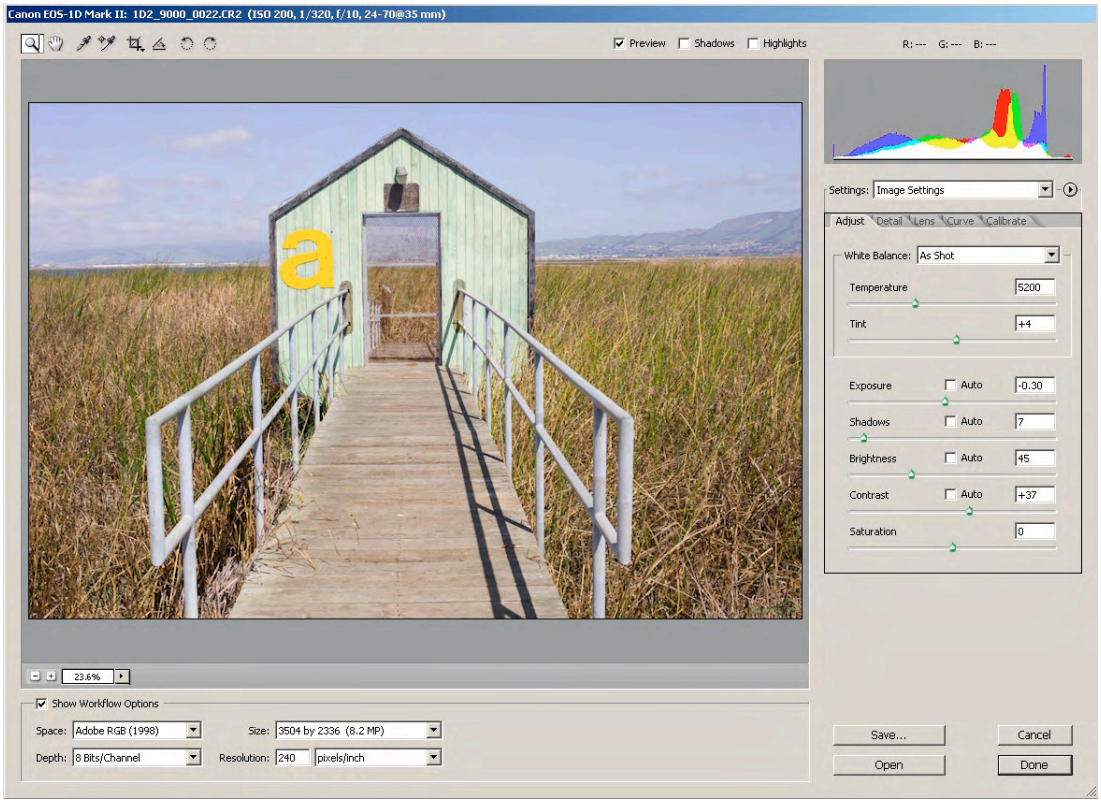


Figure 4-1: Basic ACR window

Camera Raw 2.x and 3.x can open nearly all RAW files created by today's digital cameras. When a new camera is introduced to the market you may need to wait for the next update of ACR. However, Adobe has even shipped early beta versions to satisfy its customers.

Perhaps needless to mention, everything in Adobe Camera Raw (ACR) is fully color managed: Monitor profiles are the same as used by Photoshop, and for all supported cameras Camera Raw uses built in generic camera specific profiles.

4.1 Quick ACR real life workflow

To use ACR you do not need to understand all its features. A good point to start is to describe how we use ACR for our own workflow before discussing the gory details and numerous features of ACR. We use images from a real-life photo session in Monterey, Califonia (using the Canon 1Ds Mk. II camera) demonstrating how to approach working with ACR on this particular set of images.

Transfer your images to your computer

As described in a previous chapter, we renamed all images using Downloader Pro. Here is an example: "1ds2_5001_0039.CR2":

- 1ds2 is our specific camera type code
- 5001 is a code we use to identify multiple cameras of the same type or for overrun of 9999 number limitation. 5001 is also used for a loaner camera
- 0039 is a camera internal number (camera was new at the time)

Browse the image folder of RAW files using Adobe Bridge

Figure 4-2: Folder selected in Bridge

We use Bridge in the filmstrip-mode giving the layout shown above. At this point, we could open each picture individually to work on, but this is not terribly efficient. Instead, we select all images (Ctrl/⌥-A) and open ACR in filmstrip-mode (Ctrl/⌥-R).

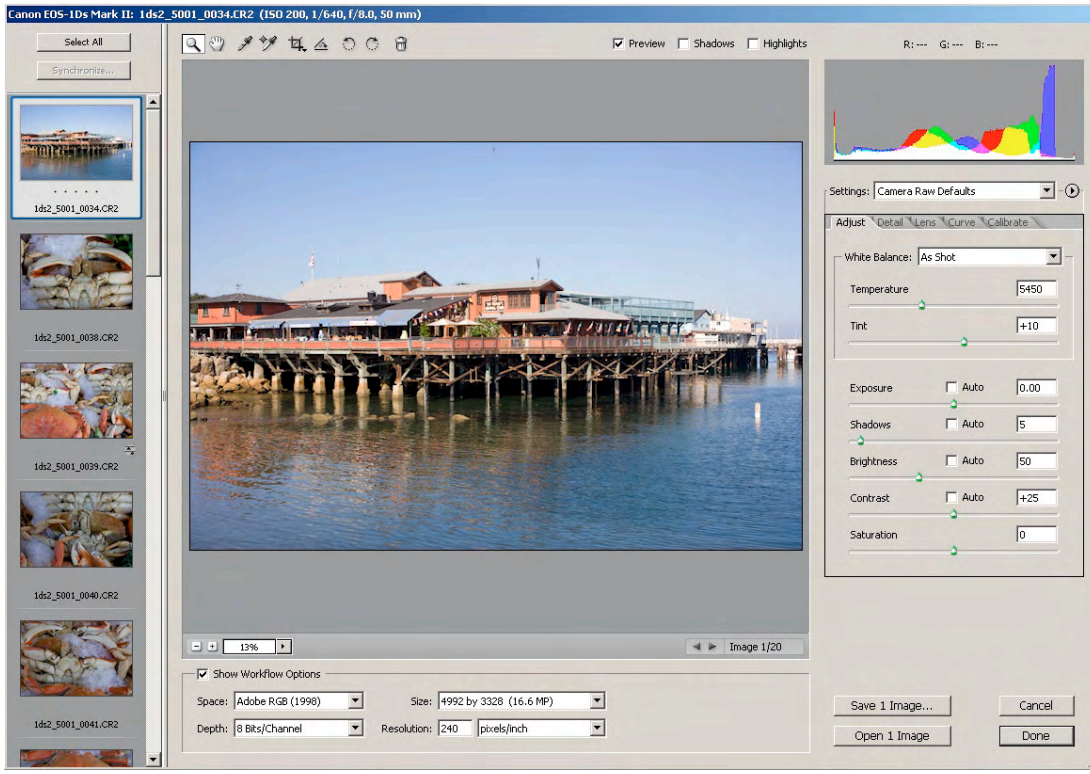


Figure 4-3: ACR in filmstrip-mode

ACR in filmstrip-mode is an important workflow improvement over older versions of Camera Raw. We now have all RAW files from our photo session in direct access, and switching from one file to the next is close to real-time on current computers.

Browse through your images

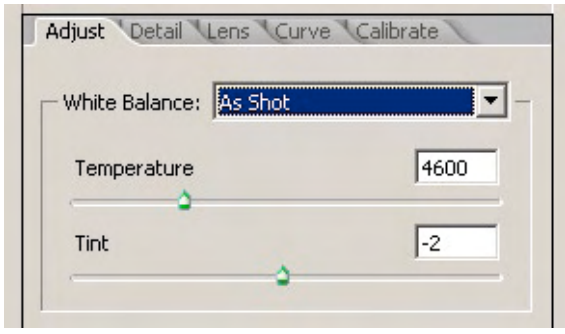
The filmstrip-mode (for other modes, see page 4-36) allows you to inspect all shots (almost) as fast as you like.

Make initial corrections to white balance

Sample #1

Figure 4-4: White balance set to "Off"

When we view the crab photo we see that all images are off in white balance. This was expected as the photo was taken in the shade, and few cameras with automatic camera-white-balance will correct this properly. ACR shows the "As Shot" WB settings.

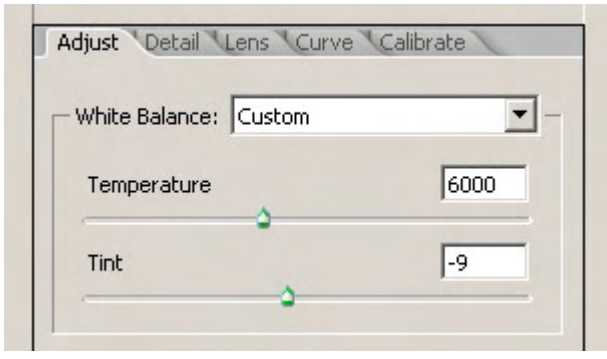


◂ *Figure 4-5: "As Shot" white balance settings in ACR*

Whenever possible, in such situations, we photograph a Mini-ColorChecker to be used as a color reference for the white balance. In this instance, however, we need to use other means to correct the WB. This is really not a serious problem as white balance for these kinds of photos is highly subjective.

We have chosen to click on the ice with the WB tool (the eye-dropper):

Figure 4-6: WB after correction (note the eye dropper cursor)



◀ *Figure 4-27: Click WB settings*

The result looks significantly better, but perhaps a bit too yellow for our taste. To reduce yellow in the image we enter a color temperature of about 5,800. Again, this is highly subjective and fully up to your own personal style and taste.

Sample #2

Figure 4-8: Cool white balance

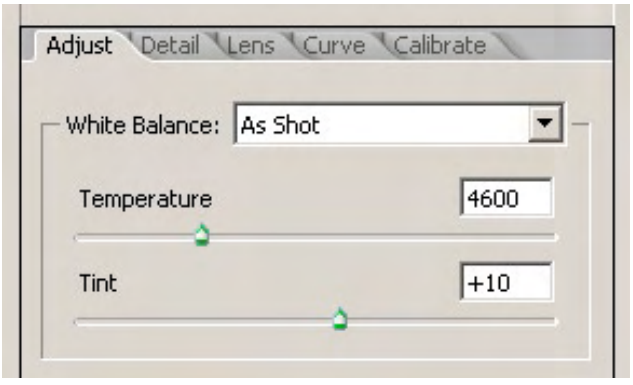


Figure 4-9: White balance settings for "As Shot"

Once more, we have no ColorChecker included in the shot thus no real defined gray as a reference point in the image. This time, we begin with a WB preset of "Daylight".

Figure 4-10: With white balance preset "Daylight"

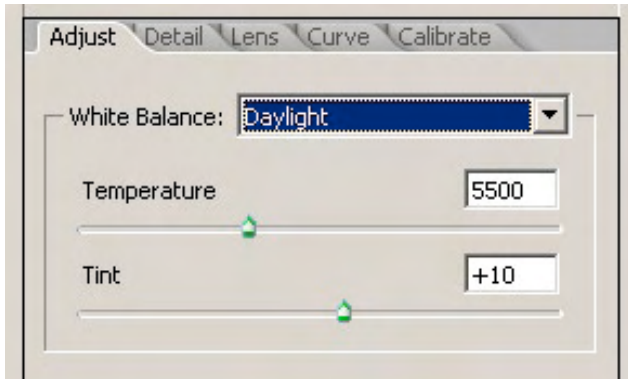


Figure 4-11: White balance at preset "Daylight"

Again, this result is a trifle too warm for our taste (highly subjective, too). Ultimately we settled with a WB temperature of 5,000, between both settings.

Apply settings from one image to other images (especially WB)

Because the other photos of the crabs were shot using the identical light, we want to apply the same WB setting to the other crab photos. Keep the current (master picture, see blue border) selected and add all the other crab photos to the selection.

Figure 4-11: Image with blue border is the "master picture"

Click on Synchronize:

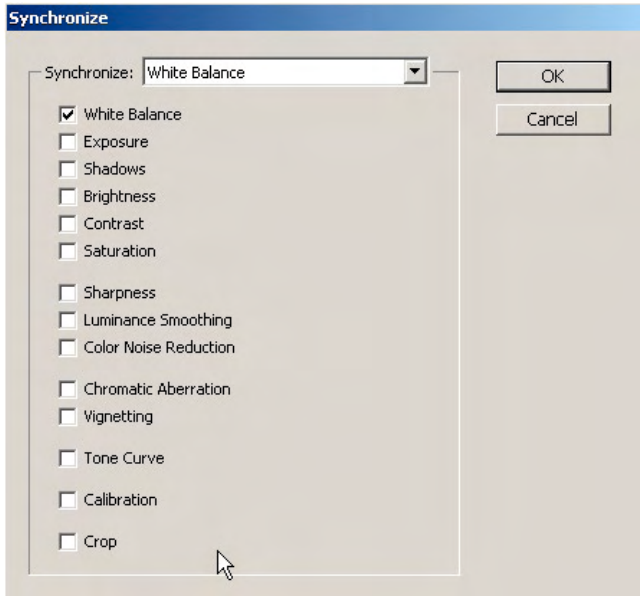


Figure 4-13: Synchronize White Balance only

Now all crab photos have the same WB settings while the other original image settings are untouched.

Tune tonality

Sample #1

Normally avoiding tools with an attribute "auto", for tonality we select the ACR "Auto Adjustments" (not yet available with ACR 2.x) to provide a solid headstart. You can easily toggle Auto Adjustments on/off using Ctrl/⌥-U. Auto adjustments are signaled by the check marks in Exposure, Shadows, Brightness and Contrast.

Let's start with Auto Adjustments ON.

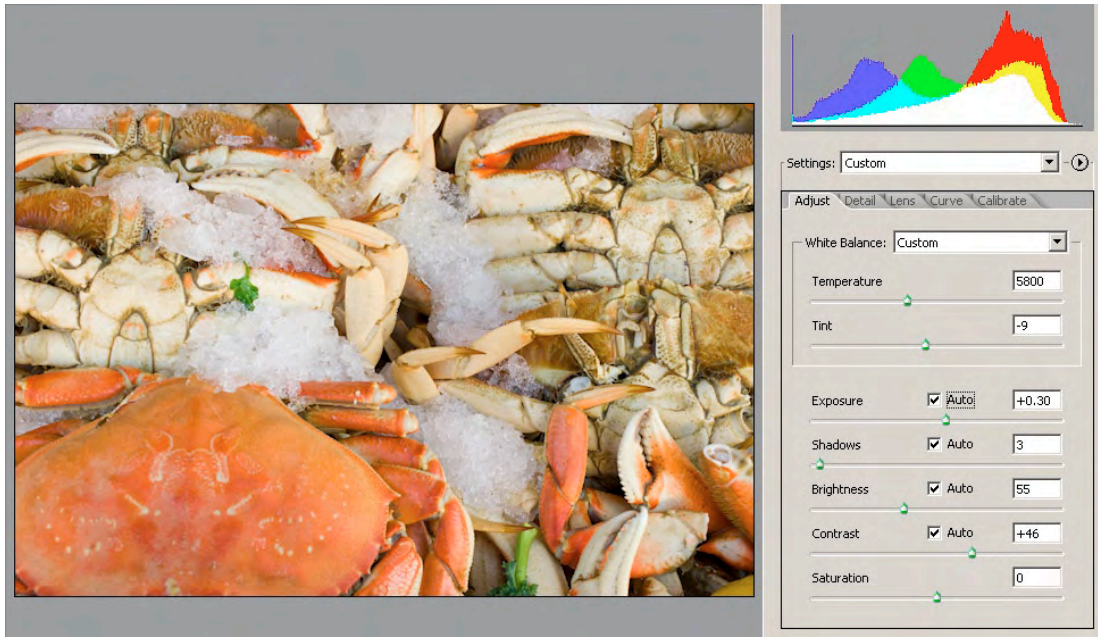


Figure 4-14: Auto Adjustments on

We fine-tune Exposure, Shadows, Brightness and Contrast manually. In this situation, we were actually pretty close to the Auto-Adjustments. The goal is to always retain shadow details and also keep the image slightly on the soft side for further fine-tuning in Photoshop.

Figure 4-15: Tonality tuned.

Tonality may also be adjusted using ACR Curves, see below (Usually leave this at a moderate setting Medium Contrast).

Sample #2

Figure 4-16: Default tonality settings

This image requires further minor tweaks:

- Avoid small aggressive highlights
- Open up the shadows

Figure 4-17: Tweaked tonality settings

In addition to these changed parameters, the Tone Curve was set to "linear":

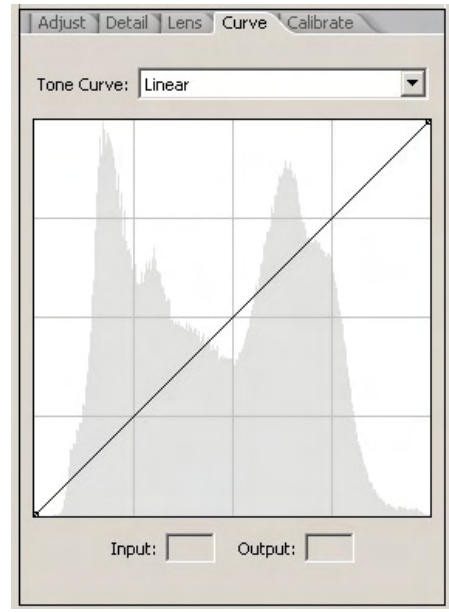


Figure 4-18: Linear curve

Organize your images for processing – rank 'keepers'

If you browse your images, you may want to rank them. ACR 3.x allows ranking from 0 to 5 stars. Later, Bridge will allow displaying only the higher-ranked images so you may concentrate on the 'keeper' photos. Additionally, images may be flagged with different colors.

ACR 2.x/Photoshop CS1 offers a simple method for flagging files by your selecting the appropriate files in the file browser and clicking the flag icon. The file browser then displays only flagged images (or if you so choose, all those not flagged).

Figure 4-19: You may rank images

Convert images in the background using "Save"

ACR 3.0 adds a new "Save" functionality allowing processing RAW files in the background (more details later).

Mark bad pictures for deletion

It is disappointing viewing your poor images, and there are often quite a few, even with the best photographers. This is especially true when shooting sports or wildlife, often at high rates of frames per second.

Figure 4-20: Image marked for deletion

Confirm or abandon all changes

You can end your browsing session with Done, Open or Cancel.

- Done: Confirms all changes including the deletion of files marked for deletion (Images deleted are actually put into the system's wastebasket where you have a second chance to recover them).
- Open: As with Done but opens all selected files in Photoshop
- Cancel: Not a single change will be performed. This tells you that all new setting changes are lost and no file will be deleted.

If you terminate your session with Open or Done ACR stores (saves) all settings. We choose to store settings in local XMP files (only if your files have non-default settings, see page ???). In this case, your folder will also display small XMP files stored with the RAW images.

Figure 4-21: XMP files store ACR settings

Perfect your 'winning' images one at a time or batch process all of them

Which of these depends on your style of post processing and also on the number of changes made, as well as, how much work remains to be done per image later in Photoshop.

4.2 Browse and evaluate your RAW images with "Bridge"

Bridge is the new file browser by Adobe for the entire CS2 suite. With CS2, Bridge is no longer a module of Photoshop, but is a stand-alone application. In the context of Bridge, ACR plays a special role: ACR can be hosted by either Bridge or by Photoshop.

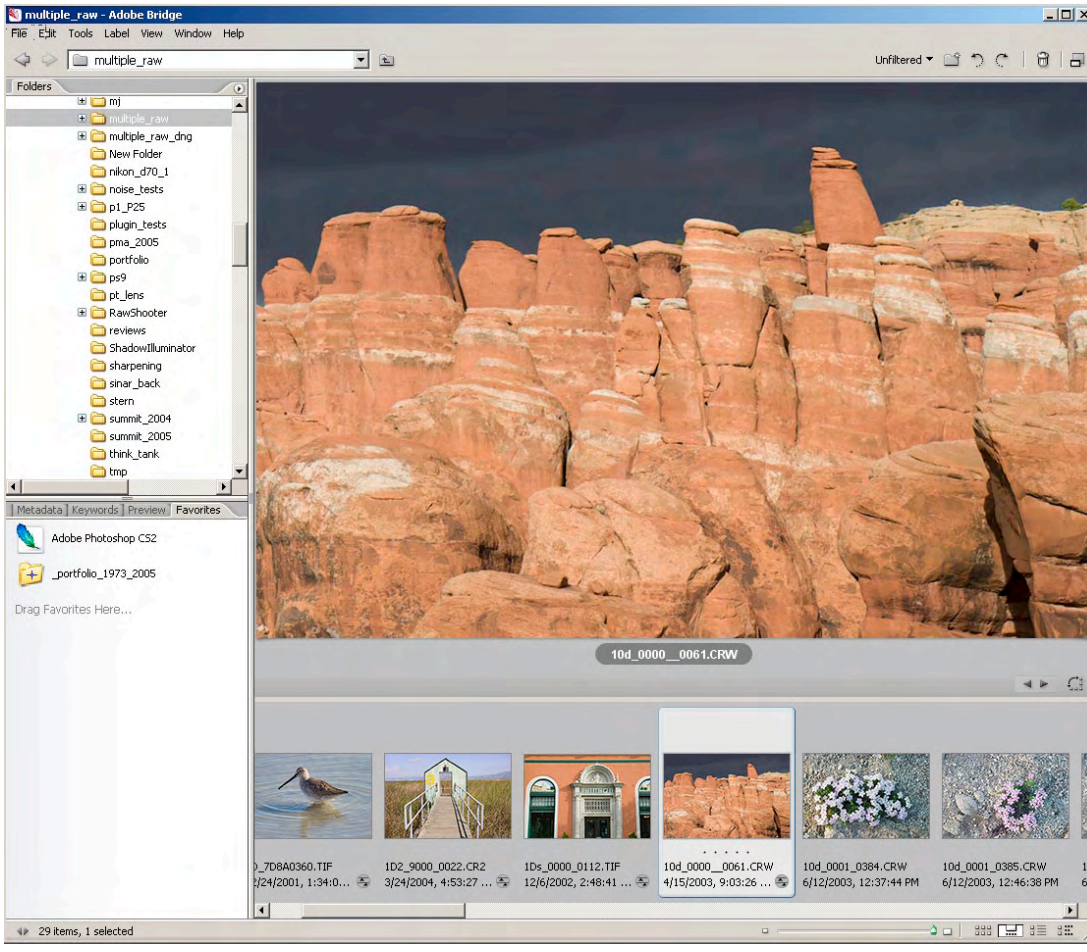


Figure 4-21: "Bridge" File Browser using Camera Raw

Bridge uses Adobe Camera Raw to create thumbnails and preview images for all supported RAW file formats. Preview images are of high quality and 1,024 pixels wide.

In the context of this book, we only cover Bridge as it is relevant to working with RAW files. There are basically two modes in which to work with RAW files in Bridge:

- Single files can be opened into ARC hosted by Bridge or Photoshop. Ctrl/⌥+O opens ACR in Photoshop and Ctrl/⌥+R in Bridge. Except for minor speed differences, it is unimportant where you open ACR.
- Working on a set of RAW files in ACR.

Working on a set of RAW files by opening the files singly is not very efficient. Capture One introduced a substantially more productive workflow. ACR has adopted a similar style of workflow. You can select a set of files in Bridge and open them all Ctrl/⌥+R in ACR.

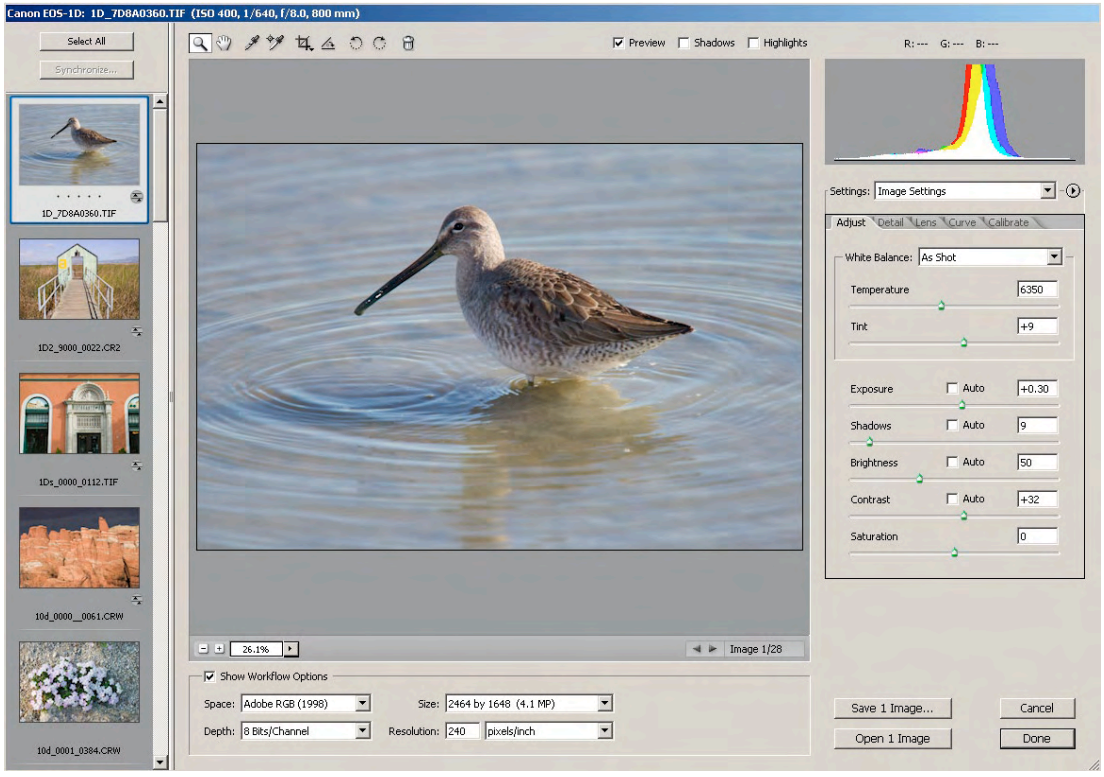


Figure 4-22: ACR in filmstrip-mode

Once you open ACR in filmstrip-mode, previews are created on the fly. For this task, ACR uses a cache. In ACR preferences you can select the location and set the size of this cache.

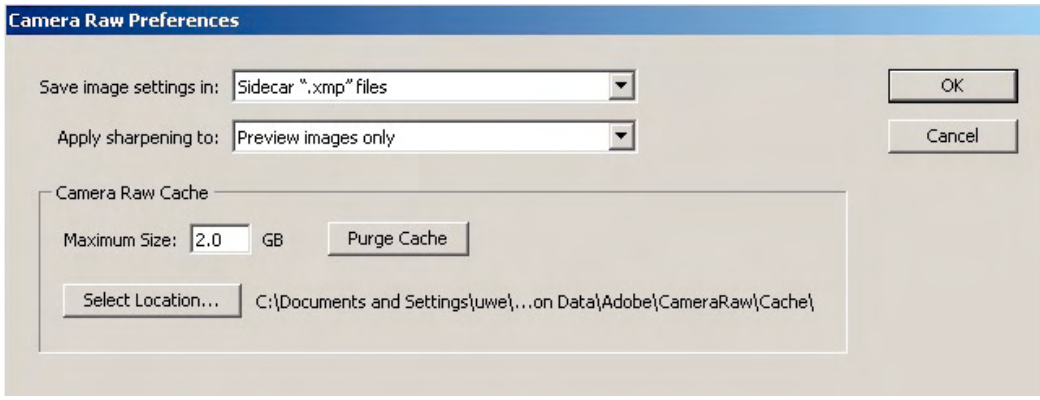
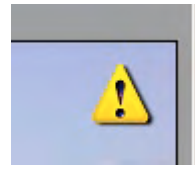


Figure 4-23: Cache settings

Best to choose a size permitting storing all previews of the largest folder you intend to process (a single preview file needs about 4.5 to 6.5 MB of disk space). This cache has nothing to do with image information (it is stored in a database or in XMP sidecar files).

Still in filmstrip-mode, you may navigate through the images in real time. Only for a brief period of time, a newly-displayed image will warn with this icon.



This indicator tells you that there may be some minor adjustments to the histogram and preview while ACR creates the full size image.

At this time, you can navigate through the image set, make changes, rate or mark images for deletion. None of these changes are permanent until you confirm them in the dialog pressing Done.

Note: If you work on a set of images, and you the press Cancel, all changes to all images in that set will be undone. Keep this clearly in mind so you won't be wasting valuable time. In fact, the deleted images are put into the system's wastebasket.

4.3 Adobe Camera Raw 3.x user interface overview

The user interface of Adobe Camera Raw is clean and easy to use. Its window can be resized up to full screen. The only downside of full screen is that some operations might slow to less than real-time which they display in a smaller window (This depends, of course, on the performance of the computer used). We use a window size that is quite large, and Camera Raw still performs well in virtually real-time.

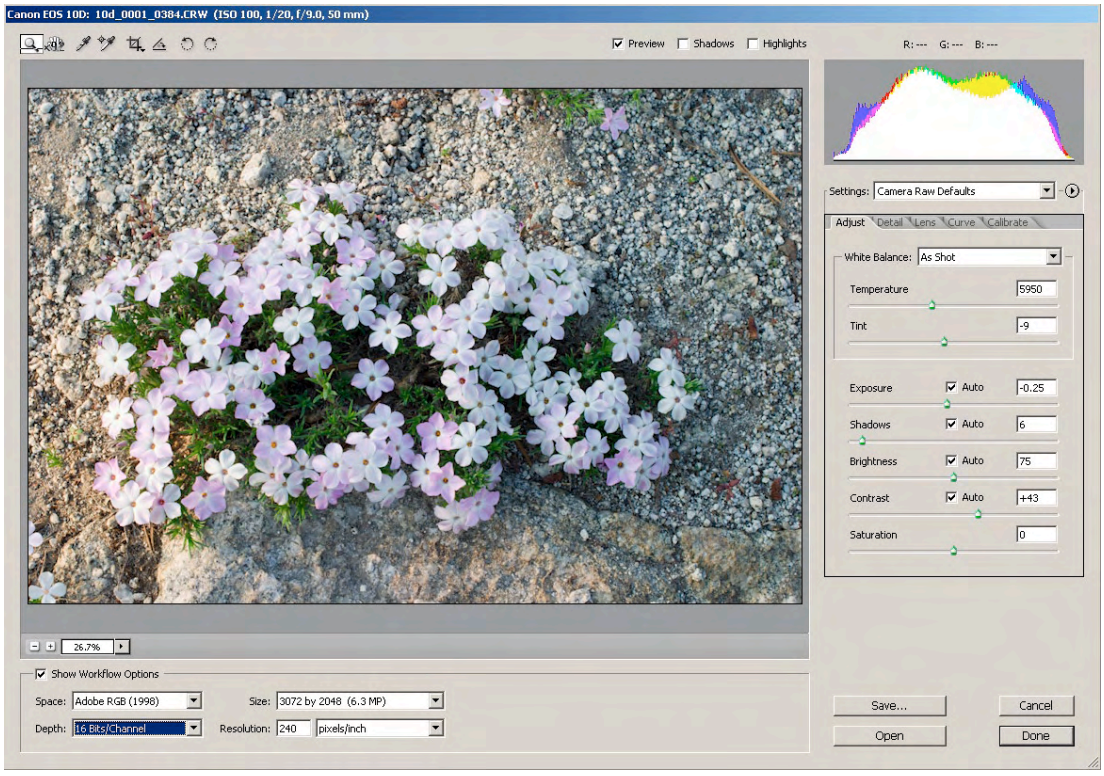


Figure 4-24: Basic Adobe Camera Raw Window

The preview image is large enough to judge color and other details. If you need to view finer details, the preview can be zoomed to 100 % pixels and beyond.

The Histogram

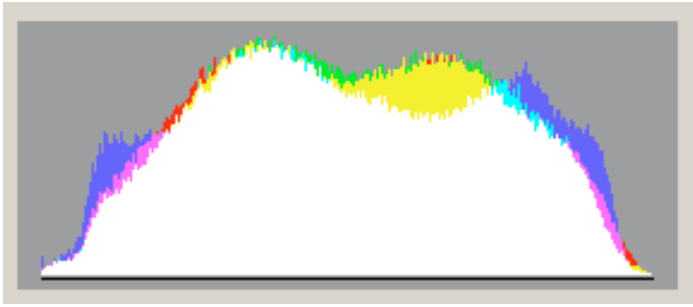
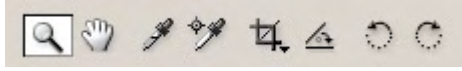


Figure 4-25: Use the histogram as an aid when making slider changes.

This illustration shows an RGB histogram plus histograms of the three individual color channels, R, G and B. The white areas are those where all three primary colors are present. Cyan combines green and blue pixels while yellow combines red and green channels. Magenta signifies that there are red as well as blue pixel values. It would be helpful if you could disable the display of the combined channels, however, that is not currently possible.

Top left Toolbar:



Zoom / Hand tool

ACR supports all the usual zooming and image moving controls that you are accustomed to in Photoshop. Normally, we set the preview to "Fit in View" as we do most detailed inspections later in Photoshop itself (This is, please note, our personal workflow style).

Eyedropper ( ) The eyedropper will be explained later when we cover WB (White Balance). The eyedropper may also be used for some RGB readouts which are displayed on the right side below the preview window.

Color Samplers

ACR 3 allows up to 9 color samplers to be placed on an image.

These can be extremely useful when desiring to monitor certain areas in images and how they are altered while changing image parameters.

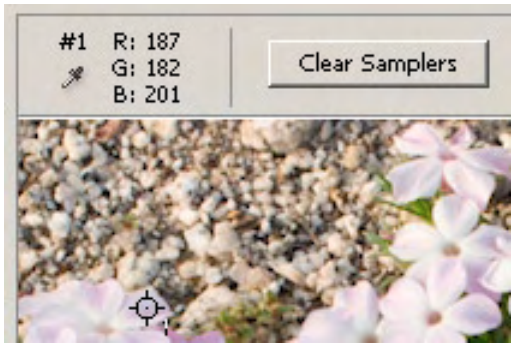


Figure 4-26: ACR color sampler

Crop Tool ACR3

You can crop images in ACR too. The crop tool also permits arbitrary rotation.

Straighten Tool ACR3

It is easy to tilt an image. The Straighten Tool is an easy way to correct for tilt. Follow a straight horizontal /vertical line with the straighten cursor. ACR will then correct the tilt automatically.

Figure 4-27: Straighten Tool

Rotating ACR3

There are two controls to rotate the image either clock- or counter-clockwise.

Workflow options

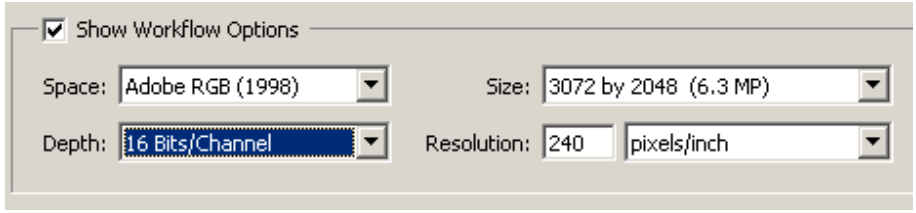
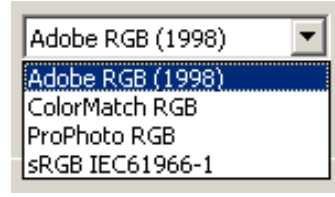


Figure 4-27: ACR Workflow Options

ICC Working Space

ACR offers four different working spaces. We use Adobe RGB (1998) or ProPhoto RGB (only for 16-bit). Currently there is no way to add additional working spaces, such as ECI-RGB.

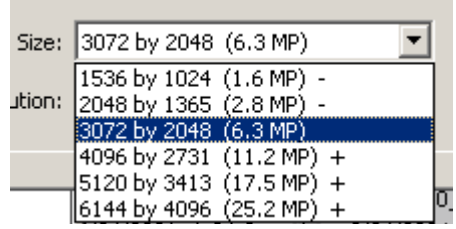


Bit Depth

From RAW files, you may either produce 8-bit or 16-bit Tiff files when converting (JPEG allows only for 8-bit files). Most of the time we use ACR in 16-bit mode.

Output Size

For most RAW file formats, ACR allows you to up/downsize an image. The algorithm used is much improved over the standard Photoshop "bicubic".



"(-)" indicates a down sampling from the native camera format and "(+)" an up sampling.

If you intend to do large format printing of your image but the native resolution of the image is not high enough for your intended size and printing method, we recommend doing your first upsizing in ACR and, if required, a second in Photoshop.

Resolution

This defines the PPI that the opened file is tagged with. We work with the standards of 240 or 300 DPI.

You likely will not change most of these options often once you use Camera Raw regularly.

Camera Raw's main image correction controls

ACR offers five tabs with controls:

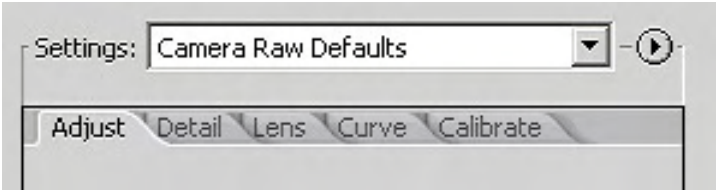


Figure 4-29: Main correction tools (tabs) of ACR when "Extended Mode" is active

- Adjust
- Detail
- Lens
- Curve (new in ACR 3)
- Calibrate

We will discuss these tabs in more detail. In most cases, you only need to bother with three of them: Adjust, Detail and Curve.

Adjust tab

The Adjust tab contains the essential controls used for any RAW conversion.

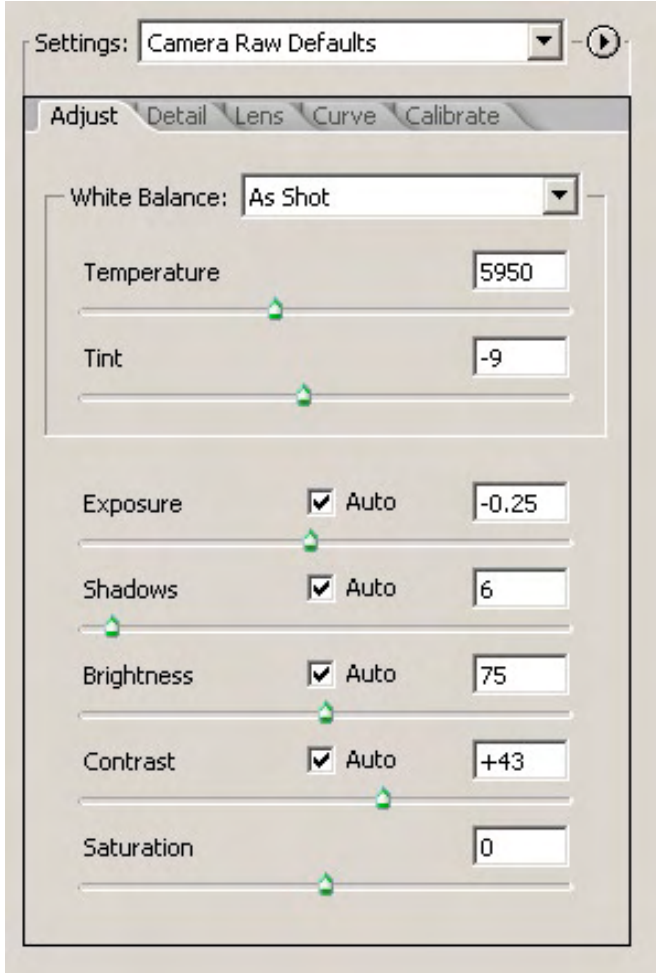


Figure 4-30: Adjust Tab of ACR

The main tasks done in any RAW converter are correcting White Balance (WB) and Exposure (EV).

White Balance (WB)

Two sliders control white balance in ACR: Temperature and Tint.

This is how Thomas Knoll (the original creator of Photoshop and also of Camera Raw) explains their function:

"To get a color to appear white, you need to get three parameters correct. This is a basic feature of human vision, stemming from the three types of color sensors in the eye.

There are several common ways of factoring these three parameters. Probably the most familiar is red-green-blue values, where white is when they are all equal to some maximum value.

Another common factoring is luminance-temperature-tint, which is what the Camera Raw plug-in is using.

Luminance is basically how bright the light is. This is what photographers fiddle with all the time by adjusting shutter speed and f-stop. The Camera Raw plug-in allows you to fine-tune this using the "Exposure" slider.

The remaining two parameters describe the "color" of the light.

If you take a black object and start heating it up, first it starts to glow red, then orange, then yellow, then "white," and then a blue-white. The exact color of this light is dependent only on the temperature of the object, and is called "black body radiation". It is usually measured in degrees Kelvin. Unfortunately, humans usually describe lower Kelvin numbers as being "warmer," and higher numbers is being "colder," which is opposite what science would suggest.

But real world light is rarely pure black body radiation. Tungsten light comes very close to being a pure black body, but other light sources usually have a color that is offset from the black body curve. On one side of black body curve, the light is greener; on the other side, the light is more magenta. Fluorescent lights are often very green. The standardized average daylight values (D55, D65, D75) are all slightly greener than black body. Flashes are sometimes more magenta than black body.

The Camera Raw plug-in has two sliders to adjust for the color of the light. The first is "Temperature," which is a closest point on the black body curve to the light's actual color. The second is "Tint," which is the offset distance perpendicular to the black body curve. Positive values means the light is greener than black body; negative means the light is more magenta than black body."

Having used nearly all other RAW converters out there in actual practice, we conclude that using only a single color temperature slider does not cut it. We consider the WB control in Camera Raw is one of the best we have seen, to date.

Of course, Camera Raw also allows a one-click WB. Click with the eyedropper on a gray or white (no overexposed white, please!) area and ACR sets the correct temperature and tint values. It is preferable to photograph a gray card or ColorChecker under the same light as other images during a photo session, correct from the gray card image and apply WB settings to all the other photos with the same lighting conditions (see saving and loading settings below).

Then there are also some standard WB presets:

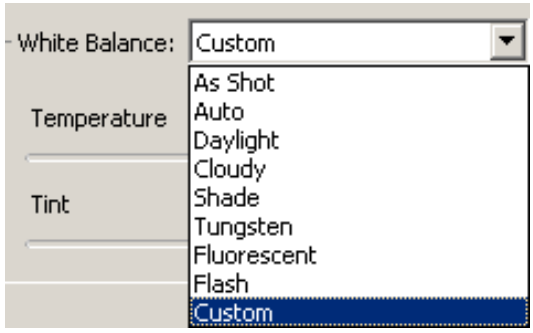


Figure 4-31: ACR offers several predefined WB settings

These presets can be used as a good starting point for manual WB correction (when you don't find a neutral/gray object in the image).

Please read the section on "Subjective WB" on page 3-8 to understand that frequently the "right" WB requires further subjective correction.

Exposure, Shadows, Brightness & Contrast

The slider Exposure allows you to control the proper settings for tonality (you can also use the Curves tool). ACR has a very powerful, unique feature to view possible blown highlights. While you drag the exposure slider, hold down the Alt key and display a threshold view (works like Photoshop Levels).

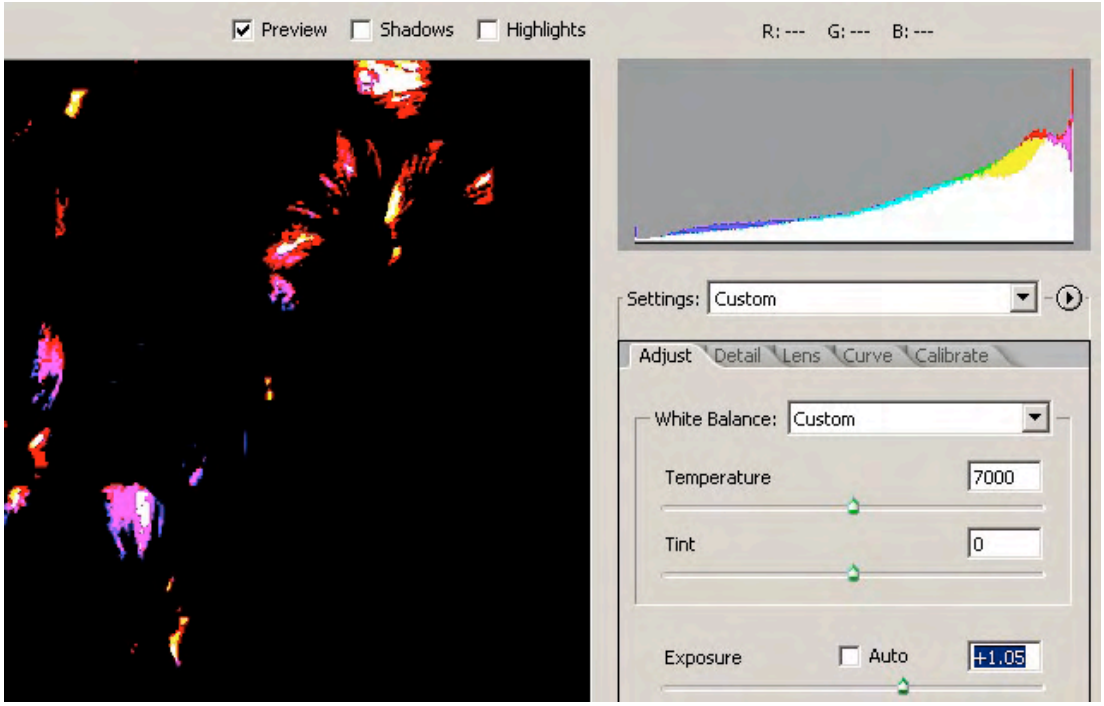


Figure 4-32: Threshold view shows clipped Highlights

If you check the Shadows and Highlights buttons at the top right top of ACR 3 window, Preview Shadows Highlights areas with blown out portions of an image are marked by ACR[ACR3] with a marking color (by default red = highlights and blue = shadows).

The Shadows slider lets you control the shadows, and, once more, the Alt key allows you to see a threshold view.

The preview and histogram are both updated in real-time.

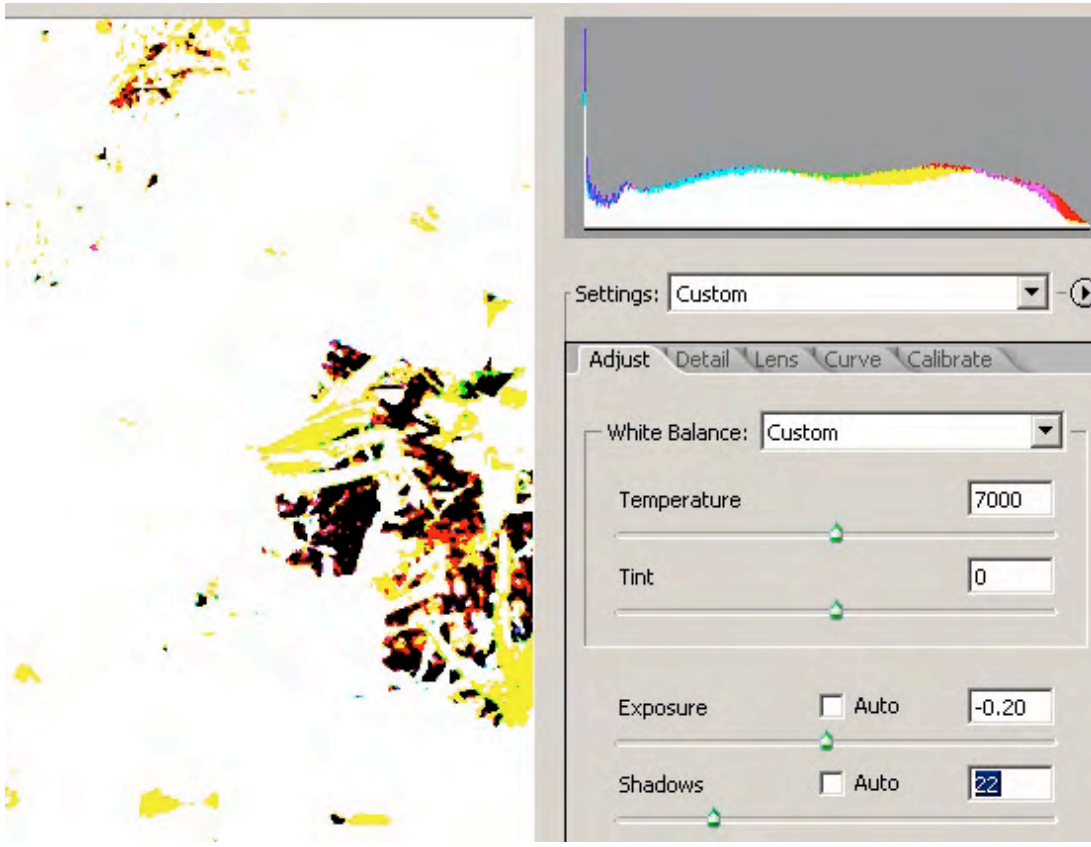


Figure 4-33: Threshold view shows clipped Shadows

Exposure

With the exposure slider you control the brightest point in your image. This means that the brightest area in your image should contain the value you choose. The brightest area should not be a white without any detail unless you have some specular highlights.

Shadows

With the Shadows slider you control the darkest point in your image. The darkest area in your image should have a value you choose. The darkest area in an image does not need to hold any detail and will be mapped to the deepest black your printer can produce.

Once you have controlled both Exposure and Shadows, then tune Brightness and Contrast.

We recommend using all four sliders to produce either the final tonality or one that is slightly soft:

- No blown highlights
- No blocked up shadows
- No harsh contrast

Certain tonality corrections needing selection or adaptive controls (like PS Shadow/Highlight) cannot be performed in ACR. You must do this final tuning in Photoshop.

Saturation

The control for saturation works quite nicely. We prefer to tune color saturation later in Photoshop and do it only for selected regions and/or selected colors usually.

Detail tab

The Detail tab includes controls that handle sharpness and noise.

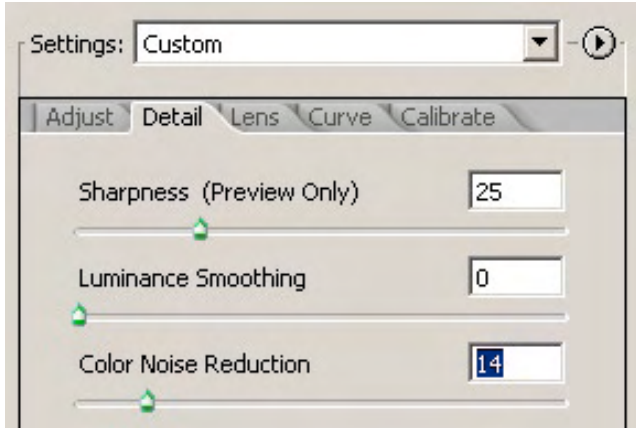


Figure 4-34: Detail tab of ACR

Sharpness

You can get quite good sharpening results with ACR's sharpness tool. There are three possible strategies:

- Do all sharpening in ACR (recommended for batch conversion)
- Do approximately 10 % sharpening in ACR and later final sharpening in Photoshop
- Leave all sharpening to Photoshop.

We currently tend to use method 3 as we have very good sharpening tools to use in Photoshop (e.g. CS Smart Sharpen or our own EasyS Sharpening Toolkit) and choose to leave sharpening as the final step.

Here is a Canon 1Ds file as an example

Figure 4-35: 1Ds image (4064 x 2704 pixels)

Figure 4-36: ACR sharpening 0 % on the left and 50 % on the right (shown at 100 % pixels)

You may also set the option *Preview images only* to prevent the converted files from being sharpened at all by ACR but still simulate sharpening in the ACR preview. This makes it easier to judge the

image now while using more sophisticated sharpening techniques later in Photoshop.

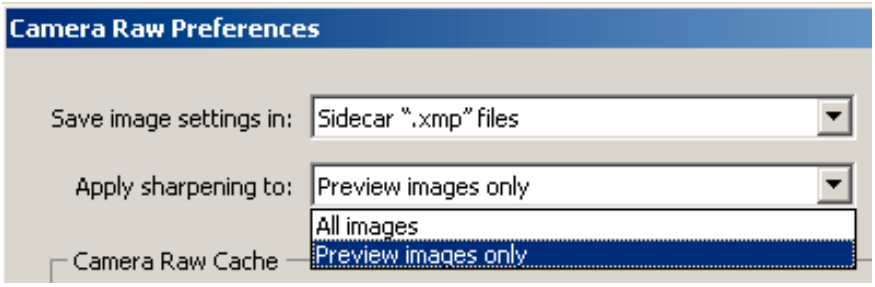


Figure 4-37: Camera Raw Preferences

We actually have the sharpening setting at zero because sharpening is done later in Photoshop (or select sharpen for preview only).

Smoothness

Smoothness controls the image noise removal. It can be controlled at two levels:

- Luminance Noise (detail noise)
- Color Noise (good values seem to be 20–30)

The smoothness control can be used to remove some noise (especially for higher ISO images). ACR tries to keep the sharpness on all edges but as with any noise filter, the images gets a bit degraded. Our strategy is to use as low as possible ISO with all our cameras to avoid later noise removal as much as possible.

Again, the general strategies are similar as with sharpening:

- Do all noise removal in ACR (only for really high ISO images)
- Do some 10 % smoothening in ACR and later more work in Photoshop using the filter Reduce Noise, Noise Ninja ([18]) or equally good tools.
- Leave all noise removal to Photoshop (again "Reduce Noise", Noise Ninja ([18]) or equally good tools, also see [17]).

Again, we tend to use the third method or, in general, do scarcely any noise removal at all.

Lens tab

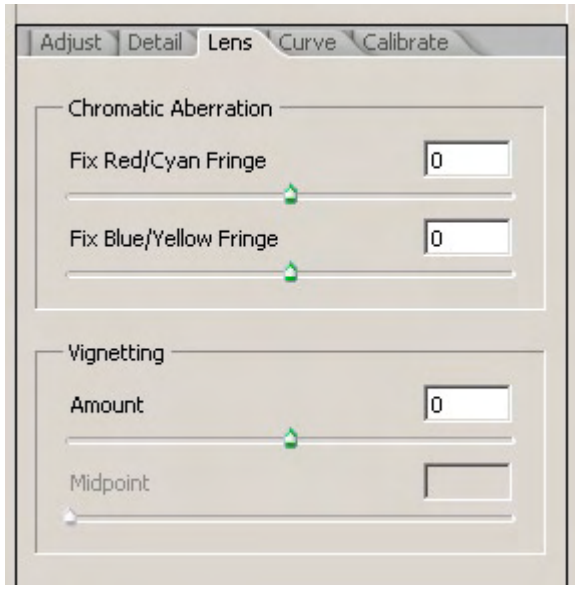


Figure 4-38: ACR Lens tab. Midpoint is grayed out, until an Amount is set.

This tab provides two very unique tools:

- Chromatic Aberration Removal (CA)
- Vignetting compensation

Lower quality lenses – but also some prime lenses used with full frame sensors – show so-called chromatic aberration (CA), mainly in corners.

Figure 4-39: Sample Chromatic Aberration and the fixed result in Camera Raw 2

CA shows up on high contrast edges. One side will be green and the other purple. ACR helps remove (or at least minimize) the effect with ease as the tool works in real time. The Panorama Tools (a free Photoshop plug-in for image stitching) also contain a CA filter but is

pretty slow, and you have to manually try to find the right values. Adobe Camera Raw chromatic aberration removal is simply first class beginning with ACR2 and worth the price of the upgrade to CS alone if you are still using Photoshop 7 and see a lot of CA in your images.

We have not felt the need to use the Vignetting filter yet. If your lens, however, shows a strong vignetting, you should do a correction in your RAW converter. As vignetting may occur a little bit off the lens center, you may use the slider Midpoint to position the center of the vignetting.

Curves tab

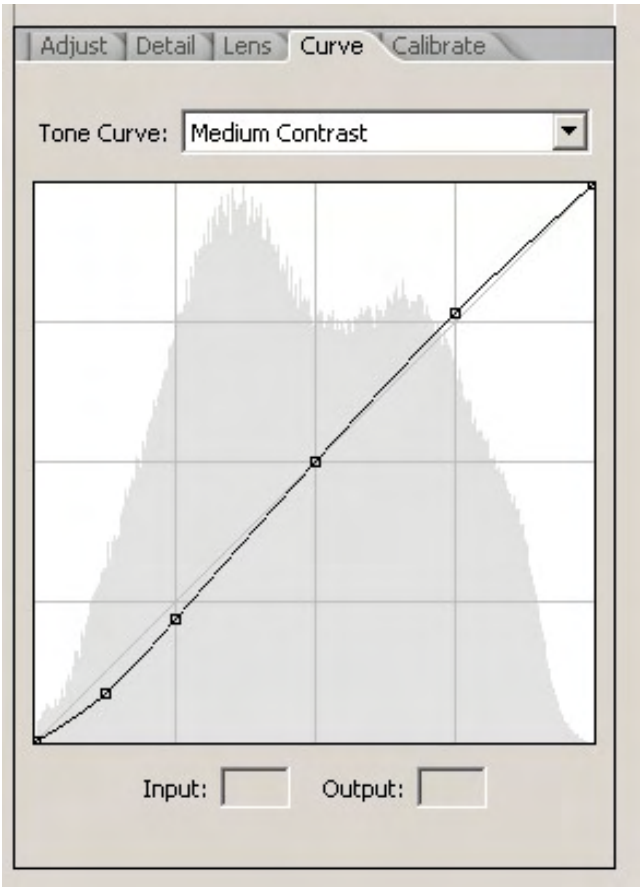


Figure 4-40: Curve Tab of ACR

In theory, you could control the entire tonality using this curves control, however, correcting using curves often is not terribly intuitive. We use it only for final fine-tuning. Some presets are provided that improve the contrast (some weak S-curves mostly).

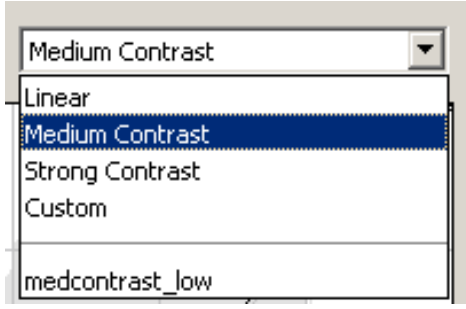


Figure 4-41: Curve presets

Officially, there is no support to create your own permanent presets. Fortunately, the developers allowed a workaround. You can save an ACR setting-subset to a file. If, at that time, you only select "Tone Curve," the settings will be saved in a different folder. These settings will then show up as Curves presets.

Calibrate tab

This is a tool that some will love while others may hate. Some RAW converters control colors for different cameras by using standard ICC camera profiles and even allow the users to replace the profiles (example Capture One DSLR).

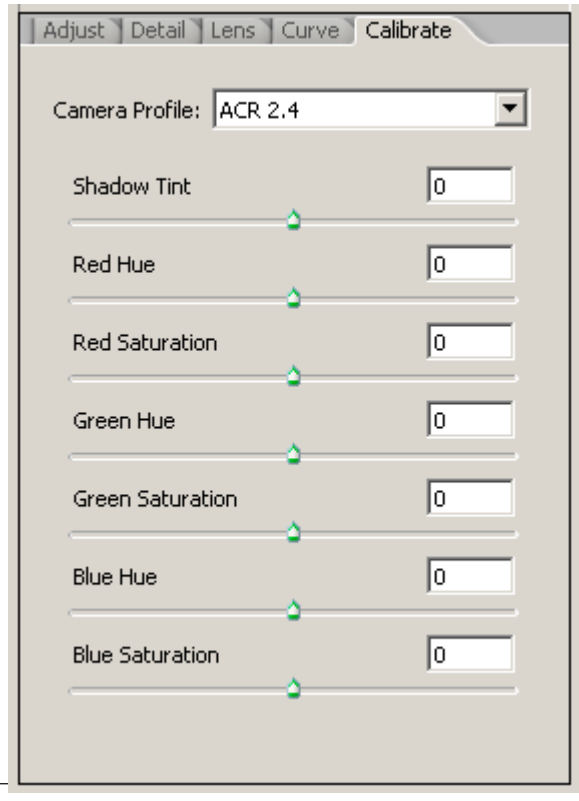


Figure 4-42: ACR Calibrate tab

This is a very powerful solution if you are able to get "good" (subjective) profiles. Creating your own profiles is not that easy, and, in our

opinion, better left to experts. There are currently third-party profiles for tools like Capture One DSLR on the market.

ACR has hard-coded Matrix profiles for all cameras. The "Calibrate sliders allow you to tweak profiles defined by ACR. This is very powerful, but you had better know what you are doing. We leave the settings mainly at the default (all = 0) but also expect that some photographers will come up with useful settings for different cameras. For more details on camera profiling see chapter 11.

How to process the images finally

All ACR versions prior to ACR 3.0 had only had the options Open and Cancel. This does not envision working with multiple images simultaneously. ACR 3 adds two additional buttons: Save and Done.

Figure 4-43: Processing options of ACR 3

It is important to understand these options and all their implications.

Save: Use Save, To convert an image and return to ACR:

Activate the Save dialog:

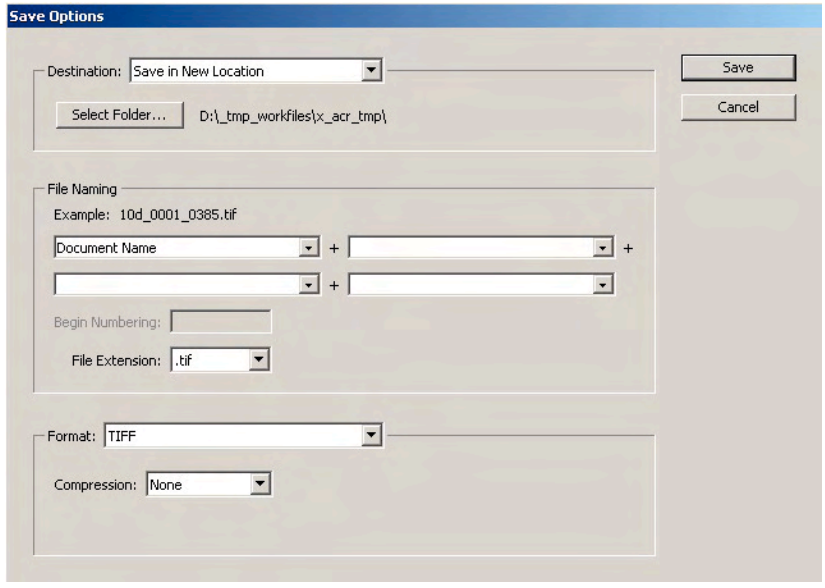


Figure 4-44: Save Dialog

In the dialog you specify:

- Destination folder for the converted image. We always use a unique folder "x_acr_temp" used exclusively for ACR output files.
- Renaming options (optional)
- Output file type (either TIFF or JPEG)

Once you press Save, you will return to the main dialog of ACR. But in the background images will get converted. The ACR dialog indicates this fact by showing a message:

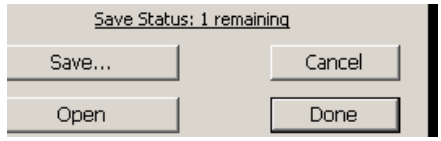


Figure 4-45: Status of background processing

What if you have many images in the queue and want to stop the rest? Just click on the message and you get this dialog:

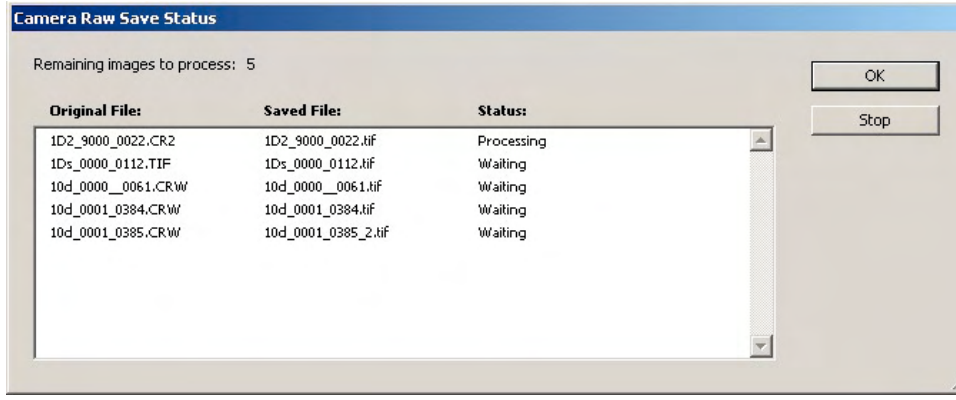


Figure 4-46: Background Save status dialog

Pressing Stop will terminate all unfinished processing.

Save may be executed without opening up the dialog by using the Alt-Ctrl-S (Mac: ⌥-⌘-S) keyboard combination.

Open converts all selected files and opens them in Photoshop. The ACR dialog is closed and all settings are save (same as Done). This also denotes that image settings for images not opened will be saved.

Done Saves all changed image settings and closes the ACR dialog. No images are opened or converted.

Cancel closes the ACR dialog without saving any changes. No files will be opened and image processing is done.

Note: If you work on a set of images and you press Cancel, all (!) changes to all images in that set will be undone. Keep this in mind to avoid wasting time. Actually, the deleted images are put into the system's wastebasket. This note is repeated here to help you avoid problems.

Saving and reusing settings

Often you want to use the same settings for an entire set of photos. There are two ways in Camera Raw to save the settings and apply them later to other images.

Save and Load settings (all settings or subsets are saved and can be restored).

Once saved into the folder "Presets/Camera Raw" these settings are also shown in the settings drop-down list. Use descriptive names for your saved settings, so you know their function when recalling them later on.

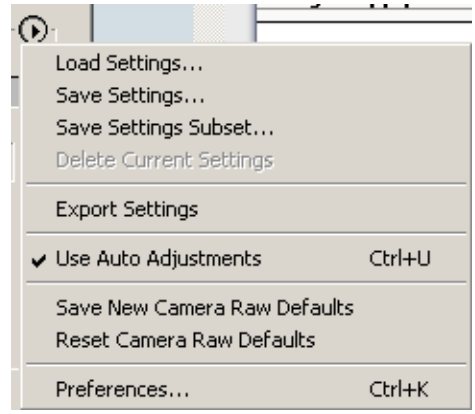


Figure 4-47: Save or load settings

Image Settings: Apply the last saved setting to this image.

Camera Raw Defaults: Apply camera type default (see next paragraph).

Previous: Recall values from the last conversion done by ACR for a picture with the same camera type.

Custom: User has changed values.

Other entries: List of user saved settings.

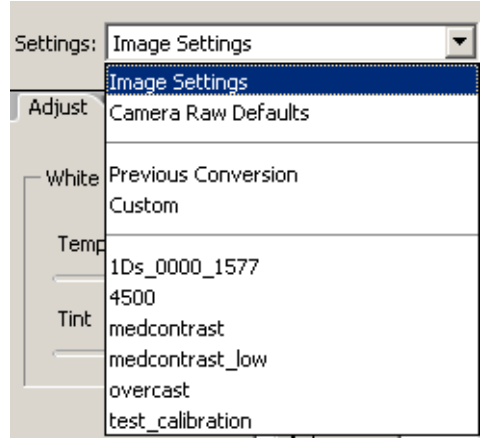


Figure 4-48: Drop-down list of settings

Recording Adobe Camera Raw settings

Looking at a converted image, you may wonder which settings were used for the RAW conversion. By using ACR for the conversion, this is no problem: ACR records all settings used in the meta information of the created file. You may recall (view) it in Photoshop by using Photoshop's File Information function (File ▸ File Info or via ⇧+Alt+Ctrl+I).

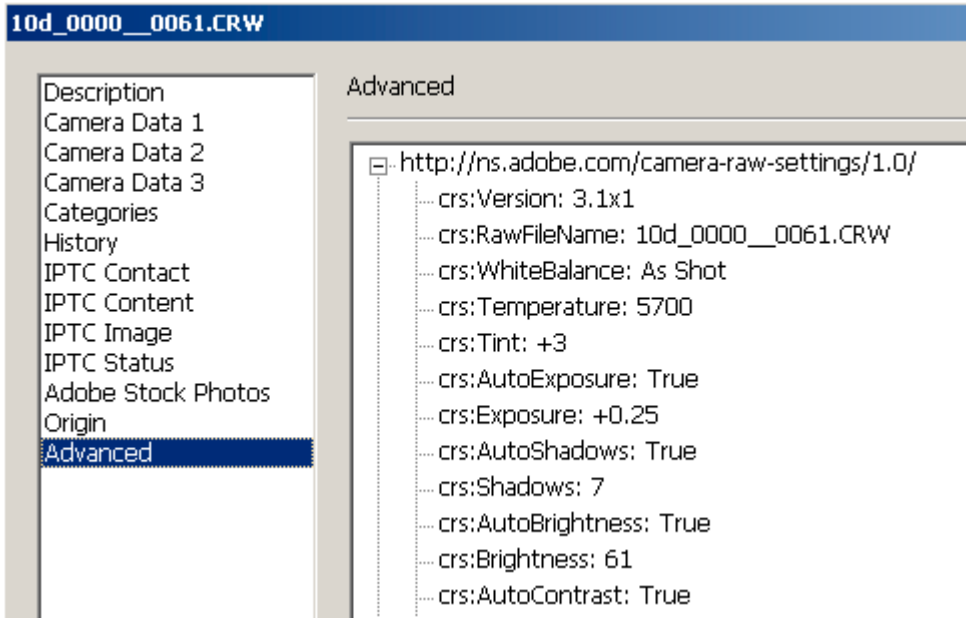


Figure 4-49: Recorded Settings

Batch conversion

There are actually three ways to do batch processing with Adobe Camera Raw:

- Provide your RAW files with the appropriate settings (e.g. call up ACR with the first image, do all corrections and save that setting. Then, you may apply this setting to all other RAW images. Select all images you want to convert using either Photoshop file browser or Bridge). Shift-double-click on the last of the selected files. This will bypass the Camera Raw dialog box and start the conversion of all images selected.
- Create a Photoshop action (see page 8-5). The action may open a file, do a RAW conversion using ACR using the assigned setting of

each individual file, open the converted image in Photoshop, do some Photoshop steps and save the image in a predefined format. Then use Photoshop's function File ▸ Automate ▸ Batch to apply the action to all files of a folder (and optionally all its subfolders).

- Use a script to do the job. A script can do operations a Photoshop action cannot do (e. g. use different processing steps depending on some predefined condition) and can use several applications like Bridge (e. g. to selection), ACR (e. g. selecting dedicated settings) and Photoshop. Adobe supports scripts either in Virtual Basic (with Windows), Apple Script (with Mac OS) or JavaScript, which may run on both platforms.
  Scripting is very powerful, but requires some learning. We recommend JavaScript, mainly for its independency of platform. There are a few (Java) scripts shipped with Bridge. Looking at them can provide you a painless start into scripting.

We go further into batch processing in chapter 8, please refer to that chapter for more information.

Advanced image corrections

When white balance, exposure and other primary corrections are done, there may still be some advanced image corrections required. Here is a list of them and how we deal with them in Adobe Camera Raw:

Noise (luminance and color noise) ▸ We rarely use Luminance noise removal as it degrades details too much. Additionally, we often leave the color noise slider at a low level (10–15). Be aware, however, that even color noise removal can result in colors bleeding into other areas.

Sharpening ▸ For optimal sharpening we use other tools in Photoshop (Smart Sharpen or EasyS Sharpening Toolkit)

Removal of chromatic **aberrations (CA)** ▸ This is a powerful option in ACR. Aside from this, you can also use the Lens Correction tool in Photoshop CS2. If you still use Photoshop CS1, we recommend you do removal of CA here.

Vignetting ▸ As mentioned before, we have few vignetting issues (vignetting mainly occurs with extremely wide angle lenses).

Cropping[ACR3] ▸ Though the cropping support in ACR is very useful, we often leave the final crop to Photoshop.

Correcting tilt [ACR3] (So easy to shoot an image unlevel) ▸ The straighten tool is very helpful in correcting tilt in images. If your image is only slightly off, we recommend doing any straightening here, especially if you convert to 8-bit output.

Perspective corrections ▸ ACR does not have a dedicated tool for perspective correction. You can use the Lens Correction tool in Photoshop CS2 though.

Dust removal ▸ Dust removal is best performed with the Photoshop Healing Brush.

Upsampling ▸ If you know you need your image up sampled, ACR provides good options. Most often we perform any upsizing later with Photoshop CS tools (see also our Upsizing articles at [49]).

4.4 Extra workflow support

Batch conversion

You can also perform batch conversions. This is done by creating Photoshop actions and using these actions in batch mode. Follow the instructions in the CS2 manual and see chapter 8 for more details. You may also create added actions for different purposes.

One reason to use batch conversions would be to create some preview JPEG images from newly captured photos, or if a set of photos has the exact same exposure and white balance (e. g. studio shots).

Background processing ▸ Like Capture One and RawShooter ACR (as from ACR 3 on) provides background processing with the new Save functionality.

Apply settings from one file to other files ▸ You can apply settings from one image to other images in ACR or Bridge.

In ACR:

- Select the original image whose setting you intend to use
- Next, select all the other images that should be adjusted.
- Press the Synchronize button.
- ACR pops up the following Synchronize dialog, where you may select (or deselect) all settings you want to transfer:

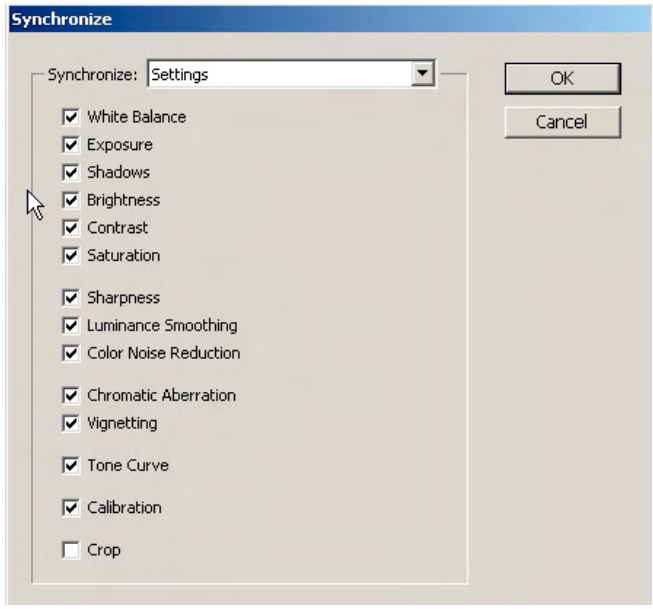


Figure 4-50: Synchronize dialog

In Bridge:

- Select the original image.
- Use Edit ▸ Apply Camera Raw Settings ▸ Copy Camera Raw Settings.
- Then select all those images that should be adjusted.
- Use Edit ▸ Apply Camera Raw Settings ▸ Paste Camera Raw Settings.
  The same synchronize dialog pops up:

Snapshots for different conversion settings ▸ ACR does not support snapshots directly. But you may save as many settings for any file as you wish.

Save/restore settings ▸ You may save your settings to a file at any time to recall later on.

Camera default settings ▸ A very important feature for any RAW converter is to have default settings applying to images created by a certain camera type. ACR allows setting defaults at any time or to set them back to factory generic settings.

Undo / redo ▸ With ACR, Undo/Redo can be used for two purposes:

- Actually going back in history
- Toggle between the last and the current state during image correction (Ctrl-Z), Mac: ⌥-Z).

In some cases ACR also supports multiple undo/redo by using Ctrl-Z and ⇧-Ctrl-Z.(Mac: ⌘-Z and ⇧-⌘-Z respectively).

Keyboard shortcuts ▸ For crucial and often-performed operations, keyboard shortcuts can save a lot of time. All the shortcuts we introduce here are important. Check the manual for others.

Support for scroll wheel ▸ There is no support for scroll wheels in ACR.

RGB value samplers ▸ Up to nine color samplers can be set using the eyedropper icon. ACR will show their RGB values in the top area of the main window.

Figure 4-51: With ACR3, you may set up to 9 color samplers.

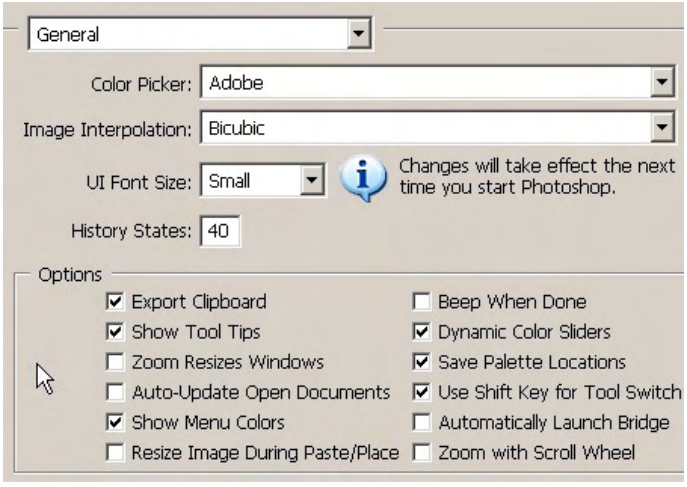
4.5 RAW files embedded in Photoshop "Smart Objects"

One of the very powerful new features in Photoshop CS2 are the *Smart Objects*. We will not cover Smart Objects in detail other than what is needed for our example. Best you read Ben Willmore's book "CS2 Up to Speed" (see Ben's book [3]).

Overall, we find Smart Objects more helpful for Designers than photographers. But there is one feature that is very powerful for photographers, indeed. You can embed a RAW file into a Smart Object layer. The process is not complicated, but is not particularly obvious. The method we describe was introduced to us by Ben Willmore.

Creating a Smart Object layer that contains a RAW file

First, we may need to change a setting in Photoshop General Preferences:



◀ *Figure 4-52: Preferences*

Make sure that the "Resize Image During Paste/Place" property is not checked.

Create a new 16-bit RGB document in Photoshop of about 300 x 300 pixels:

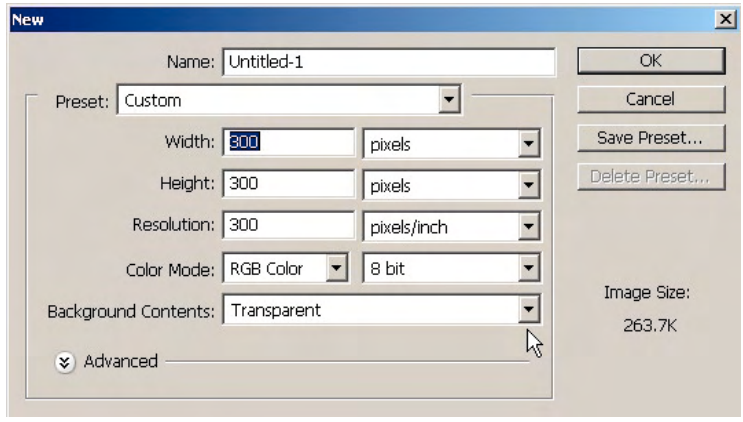


Figure 4-53: New 16-bit document

Next select a RAW file in Bridge and place it into the new document by using the Place->Photoshop command in Bridge:

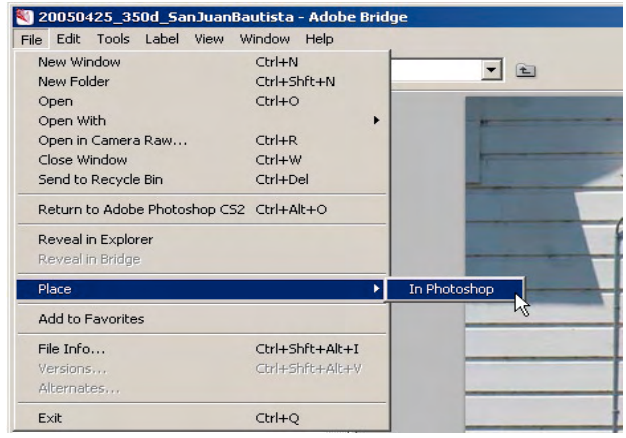


Figure 4-54: Place Image from Bridge

This will open the Camera Raw dialog in Photoshop:

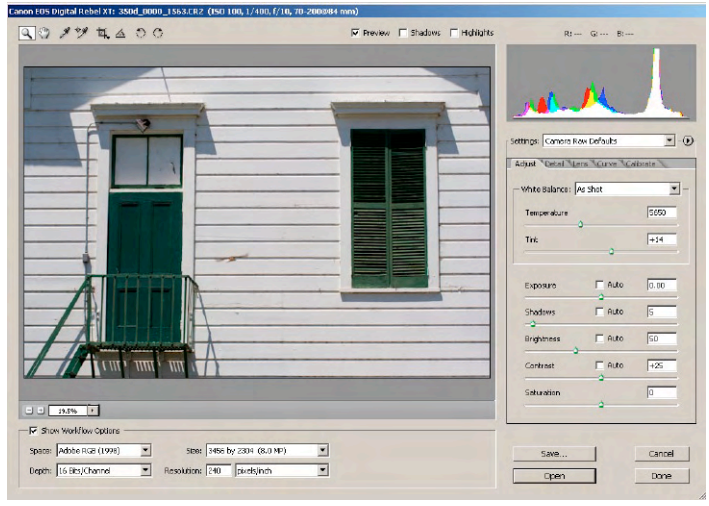


Figure 4-54: ACR for Placing a RAW file

Change your RAW settings and confirm with Open . Now you see the image of figure 4-55 in Photoshop CS2:

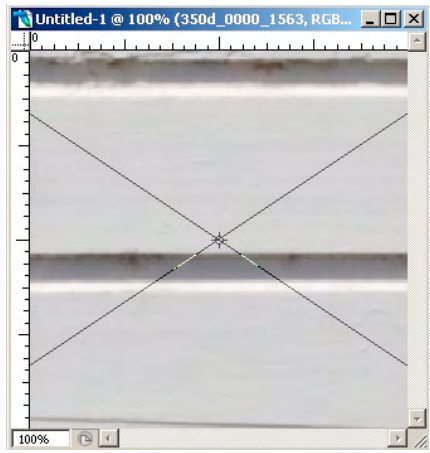


Figure 4-55: After Place

At this point the image is not yet really placed. To continue you need to confirm the placement with the Return key.

Figure 4-56: After Return

Because the RAW file is larger than our newly-created document, we view only part of it. Fortunately there is the File ▸ Reveal All tool in Photoshop available to get back to full size:

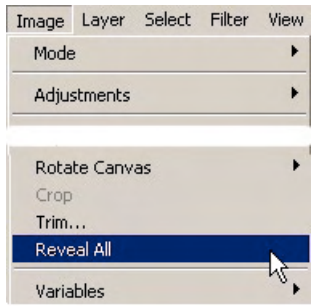


Figure 4-57: Reveal All command

At this point, we see the full-sized converted RAW image as if it would be normally as Background image. A closer inspection reveals that we have created a so called Smart Object layer containing the original RAW file. The first indicator is the different image title bar:

Figure 4-58: Page Title bar

- The file name is still "Untitled-1" while a normal opened RAW file would show the RAW file name.
- The RAW file name shows up as a layer name which indicates that we have a layer and not simply a Background image

The Layers palette shows more:

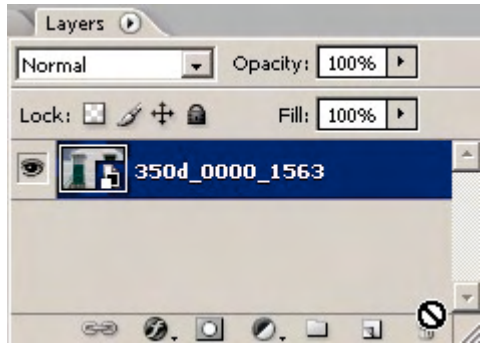


Figure 4-59: Smart Object Layer

The symbol flags Smart Objects.

Now that we finally have a RAW file as a Smart Object layer, you may ask: why is it worth the hassle? What is the big difference from using a converted RAW file as a normal Background image?

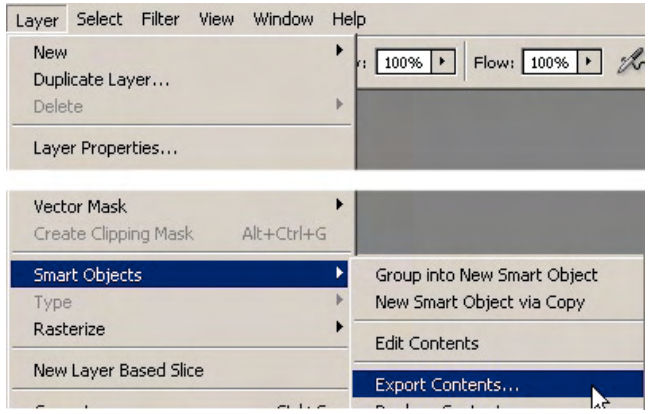
In working with converted RAW files you have the following limitations:

- If you want to change any parameters for the RAW conversion you have to begin all over again
- Also, you must locate the matching RAW file first

The RAW file in the Smart Object layer makes it much simpler. Double-click on the image icon and Camera Raw 3.x will open up again and you can fine tune your RAW conversions settings. There is no need to search for your RAW files as it is contained in the Smart Object layer. Finally all information needed for your work on a certain RAW file is part of your image.

Exporting RAW files from a Smart Object

Because the Smart Object layer contains the full original RAW file, we can even take the original file back. Select the Smart Object layer that contains your RAW file and use Layer ▸ SmartObjects ▸ Export Contents:



◂ *Figure 4-54: Export Contents*

We think that Smart Objects allow a seamless integration of RAW files and the needed final tuning in Photoshop.

Note: Dr. Brown's Services 1.0 make this whole process much easier to understand (Check out the movie at [48]).

Chapter 5

Pixmantec RawShooter (RS)

Camera: Canon 1DS Mk. II

Pixmantec RawShooter (RS for short) is a new RAW converter, created by the software designer Capture One. Capture One has proven to be very influential in the RAW converter evolution. RawShooter was designed to be very simple and quick to use. Yet its focus is excellent RAW conversion results.

As of mid-2005, there is no Mac version. That is a business decision on which we have no comment. We do hope for all Mac users that a Mac version of this technology is released in the future.

5.1 Quick RawShooter real life workflow

To use RS it is not required to know all its features. It may be helpful to describe how we use RS in our own workflow before discussing in detail the many features of RS. Again, we work with images from a real-life photo session in Monterey, California (using the Canon 1Ds Mk. II camera) and explain how we approach working with RawShooter on this set of images.

Transfer your images to your computer

All images are renamed using Downloader Pro (see chapter 3).

Browse your RAW files using the RS RAW file browser

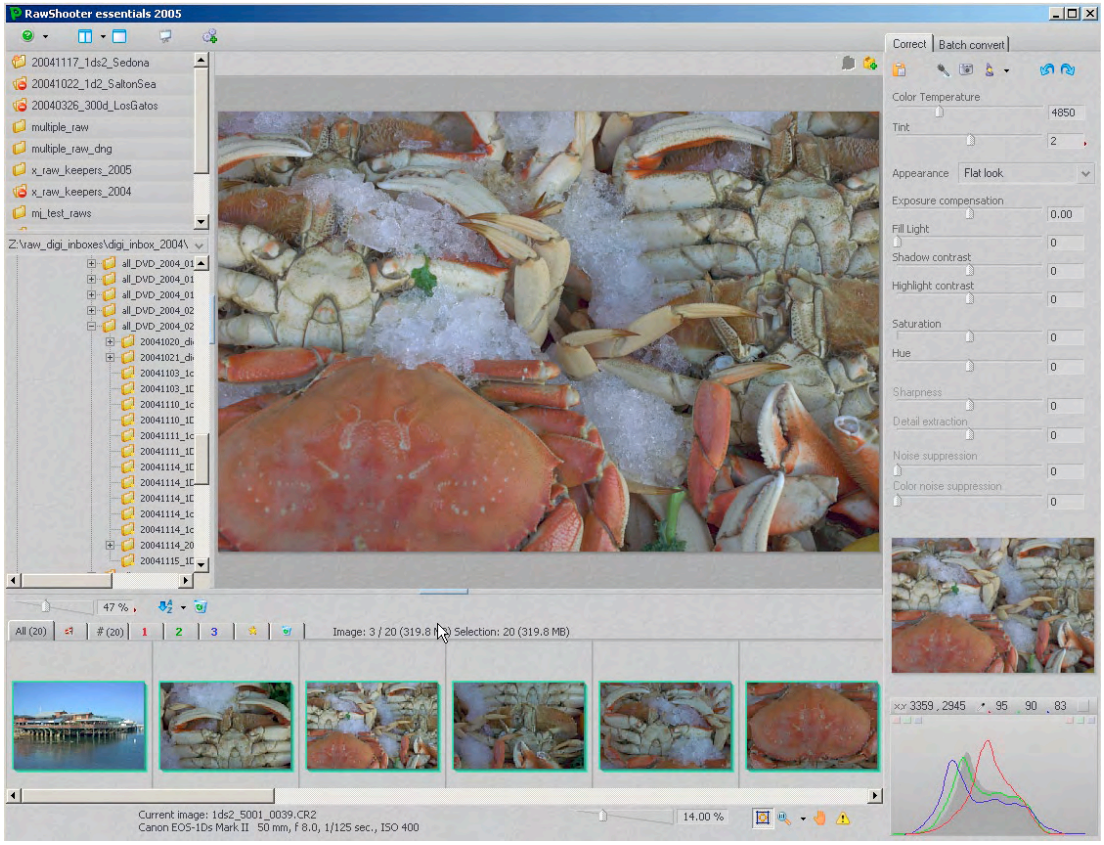


Figure 5-1: Folder selected in RS

RS has a RAW-only file browser which helps concentrate on only RAW files. The RS browser acts as a digital light box. We use the layout shown with a bottom filmstrip. When you enter a new folder,

RS creates preview files. It is advisable to wait for all previews to be created, as work goes significantly faster when previews are available.

Browse through your images

Filmstrip-mode allows you to inspect all shots as quickly as you like.

Make initial corrections to WB

Sample #1

Figure 5-2: WB Off

The crab photos seen have incorrect white balance. This was expected because the photo was shot in the shade. Few automatic camera's WB will correct for this situation. RS displays the "As Shot" WB settings:

Figure 5-3: "As Shot" WB settings in RS

As mentioned earlier, If possible a mini ColorChecker may be photographed. In this case, however, we will use other means to correct the WB. Because white balance for these kinds of photos is highly subjective, no serious problems are encountered .

We have chosen to click on the ice with the white balance tool:

Figure 5-4: White balance after correction (note the eye dropper cursor)

Figure 5-5: Click WB settings

This has improved white balance. After tonality is improved, the image may still need some tweaking.

Sample #2

Figure 5-6: Cool white balance

Figure 5-7: WB settings for "As Shot"

Again, we have no ColorChecker, but also no real defined gray occurs in the image. For that reason, we change the color temperature by adjusting the "Color Temperature" slider.

Figure 5-8: With WB at Color Temperature 6000K

Figure 5-9: WB set to 6 000 K

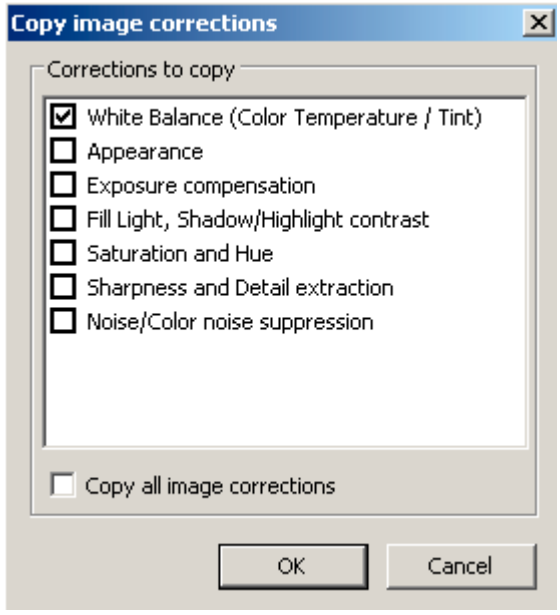
The result is slightly too warm for our taste (this is highly subjective). Finally we settled on a WB temperature of 6,000 K. Again changes to the tonality may suggest revisiting the WB settings.

Apply settings from one image to other images (especially WB)

Since all other photos of crabs were shot in the same light, we wish to apply the same WB setting to the other crab photos. Keep the current (master picture) selected and add the other crab photos to the selection.

Figure 5-10: Select master and target images

Click on the copy settings button



◀ *Figure 5-11: Copy "White Balance" only*

Now, all crab photos have the same WB settings leaving the other original image settings untouched

Tune tonality

Sample #1

Normally we ignore tools that proclaim the attribute *Auto*. But for tonality correction, the RS "Auto Exposure" often provides us a head start (keyboard shortcut Alt-E).

Let's begin using Auto Exposure. It changes settings for Exposure, Fill Light, Shadow Contrast and Highlight Contrast.

Figure 5-12: Image using Auto Exposure of RawShooter

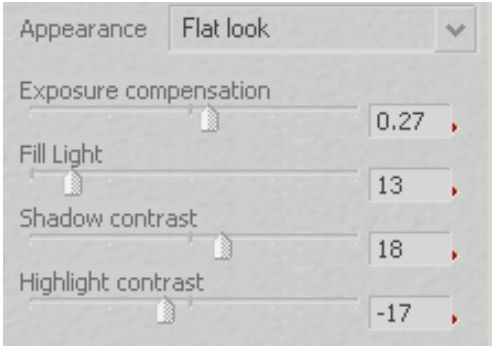
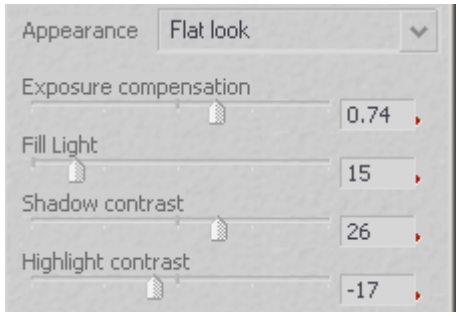


Figure 5-13: Auto Exposure

This adjustment brought much more life to the photo. It requires tweaking to make it a bit brighter. Overall brightness is achieved using the exposure slider, brightness in the shadows with Fill Light (No equivalent for this in other RAW converters).

Figure 5-14: Image of figure 5-12 after some tonality tuning



◂ *Figure 5-15: Tonality tuned*

Comparing the original image to the final result is quite impressive; how a few slider changes can make such a huge difference.

Sample #2

Again we start with Auto-Adjustments (Alt-E)

Figure 5-15: Image in RS using Auto-Adjustments

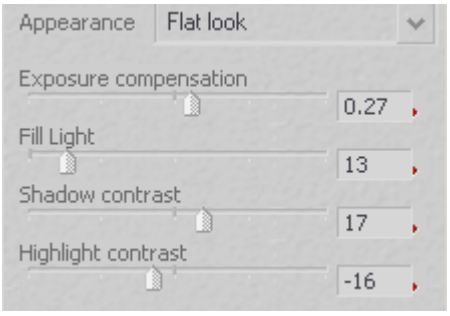
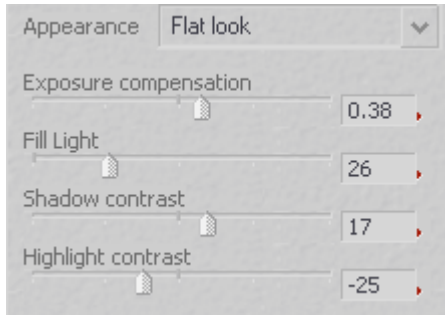


Figure 5-16: Auto Exposure

There remain minor tweaks:

- Brighten the image overall
- Open the shadow up (more Fill Light)
- Keep some aggressive highlights in check

Figure 5-17: Image after tweaking Exposure, Fill Light, Shadow contrast *and* Highlight contrast *contrast*



◂ *Figure 5-18: Tweaked tonality settings for image of figure 5-15. The result is shown in figure 5-17.*

It takes less than 30 seconds to achieve a first usable result.

Rank/Prioritize keepers

Prioritize images

Browsing your images, you may want to prioritize them. RS allows flagging them, ranking from 1 to 3. By doing this, you can display only the first-ranked pictures if you choose to do that:

Figure 5-20: RS now only shows those images with priority 1 (there are 3 of them).

Convert images in the background

At any time, convert single or sets of images in the background by clicking the Process button or just hitting the Insert key.

Mark bad pictures for deletion

◂ *Figure 5-21: Mark image for deletion*

No matter how unpleasant it may be to view your poor shots, which happens to even the best photographers, you can mark those poor images for deletion. When an image is marked for deletion, it is not actually removed immediately. Rather, it is moved from the all images tab to the wastebasket tab. If you then view images at the wastebasket you may undelete them by clicking the delete button

on the thumbnail view again. For final deletion, next press the button. RS pops-up a warning dialog. If you confirm it, your images will be removed completely (you will no longer find them in the system waste basket):

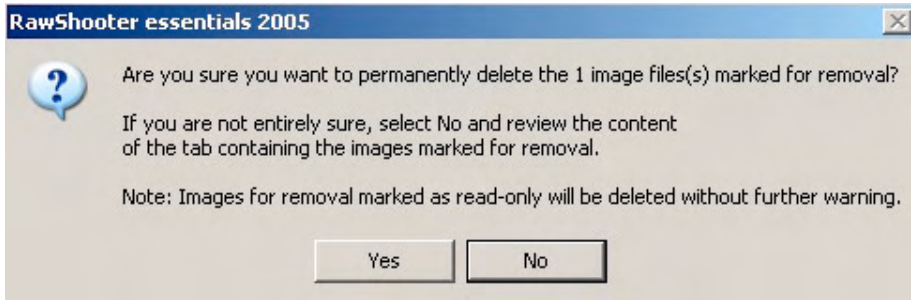

RawShooter essentials 2005
Are you sure you want to permanently delete the 1 image files(s) marked for removal?
If you are not entirely sure, select No and review the content of the tab containing the images marked for removal.
Note: Images for removal marked as read-only will be deleted without further warning.
Yes
No

Figure 5-22: You receive a warning before images are deleted

All changes are always permanent

RS stores all settings permanently in some settings file:

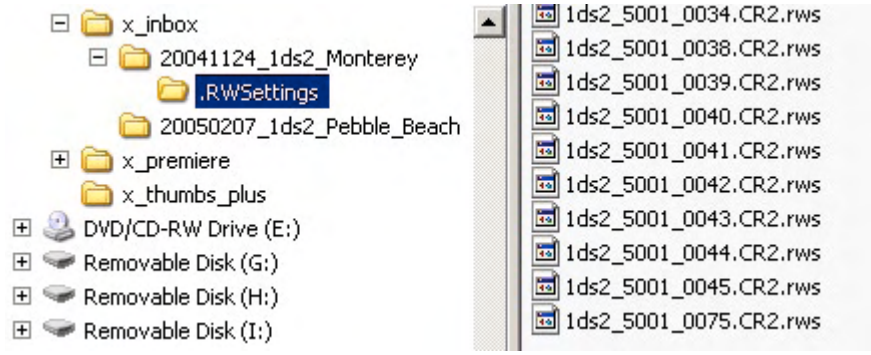


Figure 5-23: Setting files used by RS

The setting files correlate to each folder stored in a subfolder ".RWSettings".

Perfect your winning images one at a time, or batch process them all

Whether you convert images individually or use batch processing depends both on your style of post-processing and on the number and kind of changes required.

5.2 Getting started (setup RawShooter)

Note: Even though a lot of details are covered here, this book does not replace the manual. Further details and principles are covered in our e-book DOP2000 ([47]).

After installation, you must register and RS is ready to go. There is not much to setup, but we suggest the following:

- Select the "Batch convert" tab.

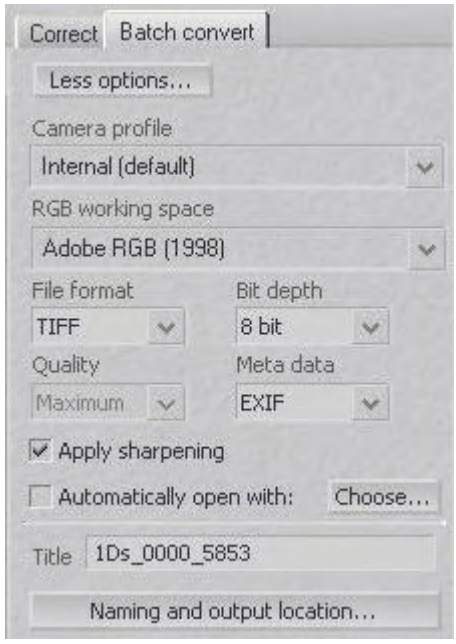


Figure 5-24: Batch convert tab

RGB Working space: We use either 8-bit Adobe RGB or 16-bit ProPhoto RGB All as shown on the above screen shot.

This is the first RAW converter used with its sharpening set to "on". Later we may add minor sharpening with EasyS in Photoshop.

You can also open converted files directly into Photoshop. We don't do this most of the time because we have a different browser displaying the folder with converted files

You may also use custom camera profiles, but, in our estimation, the internal profiles are quite good. We will not feature explanations on how to use custom profiles, but RS fully supports these profiles and their creation process (see Preferences).

Open the "Naming and output location dialog":

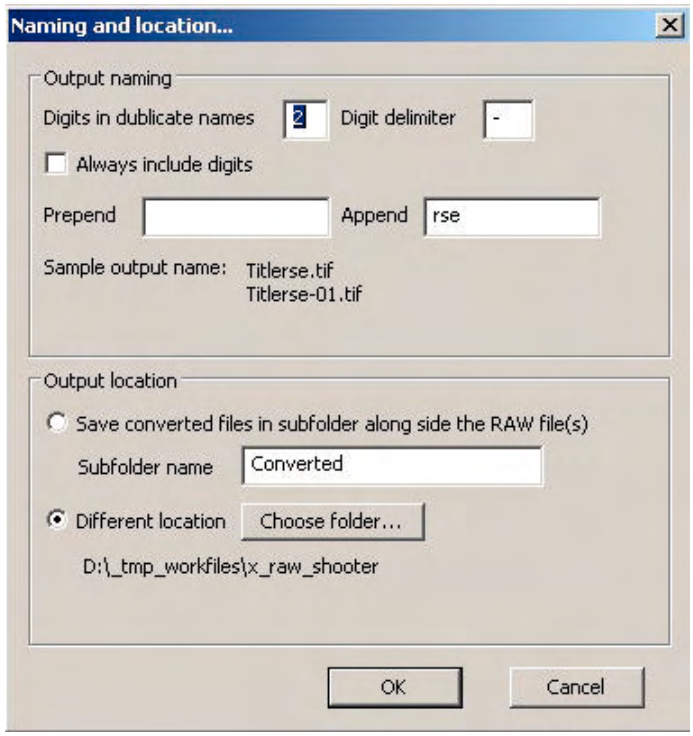


Figure 5-25: Set up the naming and location for converted RAW files.

We created a special folder for all converted files (D:_tmp_workfiles\x_raw_shooter).

5.3 Inspect and browse your files with RawShooter

Note: As the name implies, this is a browser for RAW files only.

The RAW file browser supports various features. First, you can select from 5 different layouts to which you can switch 'on the fly.' We use option #5 – filmstrip-mode:

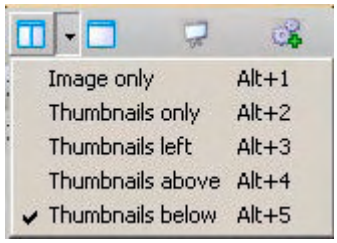


Figure 5-26: Different layout options

Our main layout looks like that of figure 5-27:

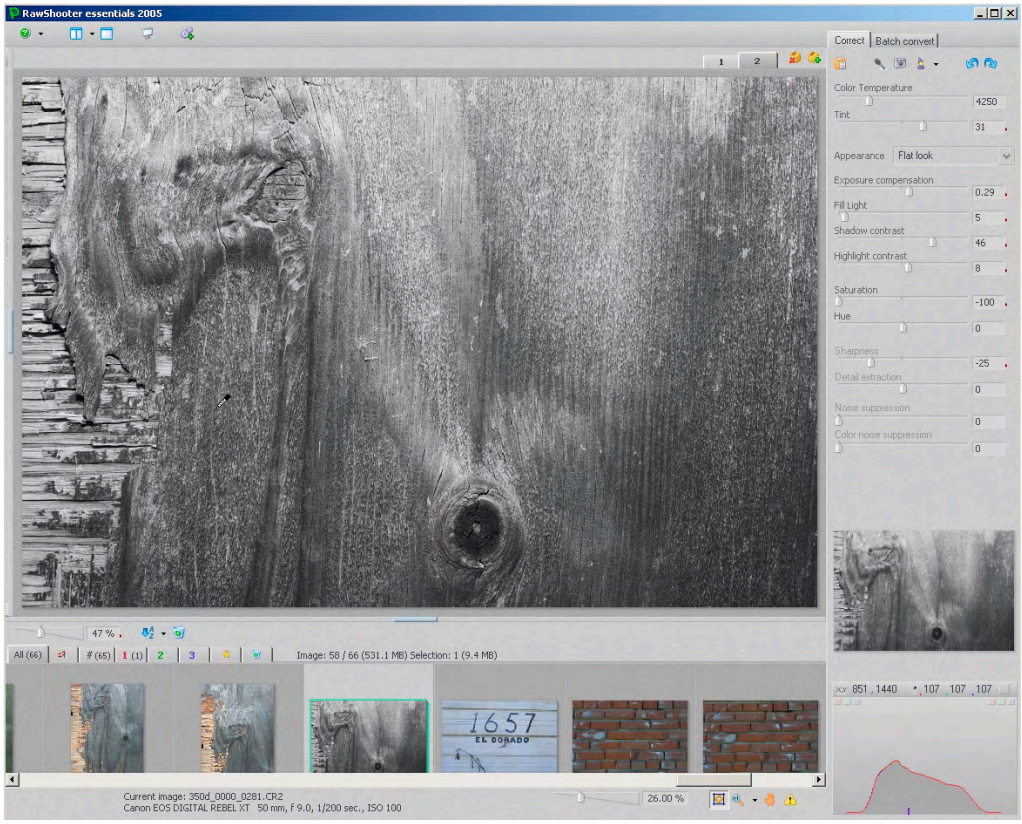


Figure 5-27: Viewing option #5 with filmstrip-mode

At figure 5-28 you find the folder browser and favorites list:

At any time you can add a folder to the list of favorites (either right context menu or via drag/drop). Favorites are crucial to get quickly to your last projects.

Once you have selected a folder, RS will start to create previews and thumbnails. RS is notably very fast but using

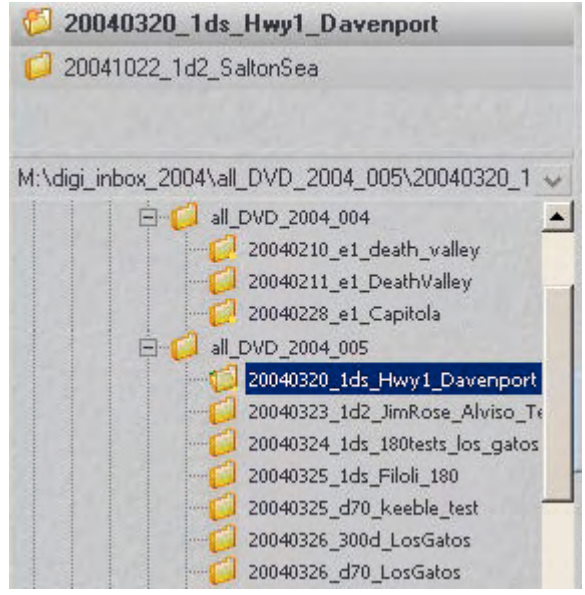


Figure 5-28: Folder navigation of RS

folders with many large RAW files will take some time. Two indicators in RS preview that building is in progress:

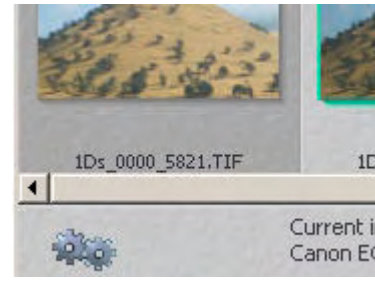


Figure 9-29 ▸ Progress wheels.

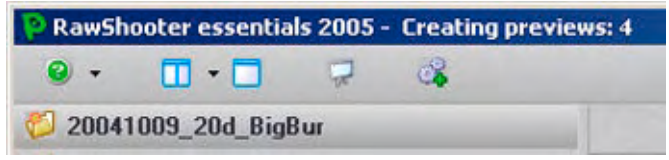


Figure 5-29: Window top border shows how many previews are still to be created

Once previews have been created, the workflow is quite fast. The filmstrip area allows organizing your images into different priorities:

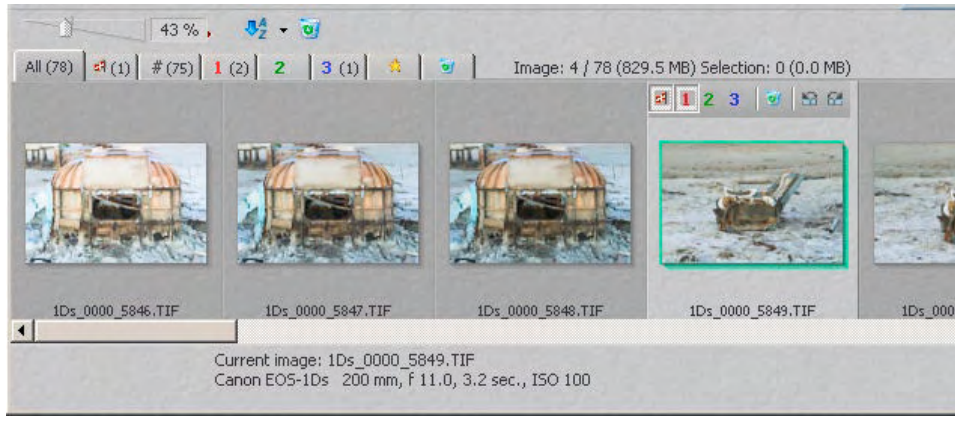
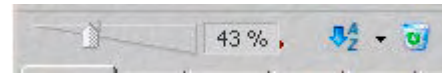


Figure 5-31: Filmstrip

There are eight tabs on top:

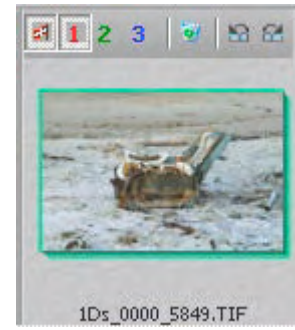
- All images in the folder
- All flagged images in the folder
- All images with no priority and not marked for deletion
- Images of priority 1, 2 or 3 (easily tag all files)
- Recently processed images
- Images marked for deletion (if you then finally delete them they are gone for good)



- The filmstrip toolbar allows control of appearance:
  - Size of the thumbnails
  - Sorting order (name or date)
  - Finally, delete images marked for deletion.

For any single image, perform the following operations on thumbnails:

- Flag image
- Set priority to 1, 2 or 3
- Mark for deletion
- Rotate by 90 degrees, left or right



Once you have selected a folder and want to work on a single image, use the full image view (Tab it toggles between both views):

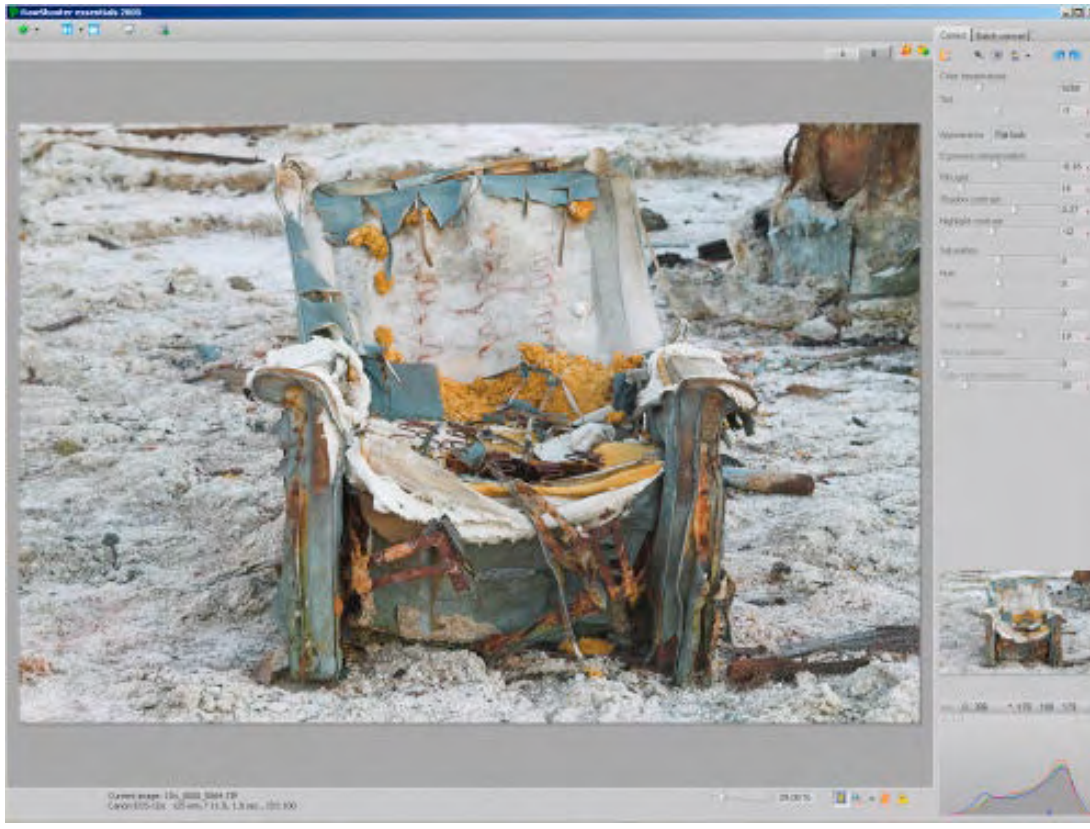
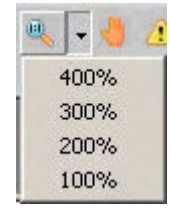


Figure 5-32: Work view

You can scale the image up to 800%. 100–400% are pre-defined settings:



RS allows conveniently toggling between "fit View" and the last selected zoom level by using ⇧-Tab.

If you work with zoom levels, the navigator panel helps to find the right locations.

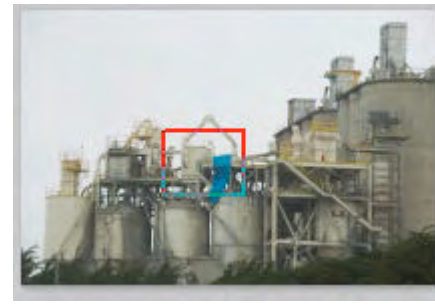
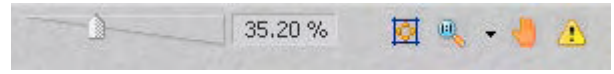


Figure 5-33 ▸ RSE navigator panel

Here are controls for the main view:



- Zoom level
- Fit to screen
- Zoom presets
- Hand tool (better to use the space bar)
- Show under/overexposure warning colors (can also be activated on-demand using the Ctrl key).

Preview size

RS provides full-sized previews for all cameras. Working with 100% views or larger is much more convenient than in Capture One (check out the slide show – see below).

Deletion workflow

Deleting files is an important and critical process. In RS you mark files for deletion on a folder-by-folder basis. Once you have marked all files that you want to delete in a certain folder, you can revisit all those files in the "marked for deletion" tab (e.g. presented in a slide show – see below). To undelete a file, just uncheck the deletion mark on the thumbnail pane. When you are sure you want to delete marked files, click on the wastebasket icon and remove the images completely (they will not show up in your system waste basket).

Some useful keyboard shortcuts

As with other tools, RS provides a number of keyboard shortcuts to speed up work and which you should keep in mind for efficient working.

Tab:	toggle browser to image view
Ctrl:	show over-exposure indicator colors
Ctrl-Tab:	toggle between zoom and fit size view
Alt-E:	Auto exposure (good starting point)

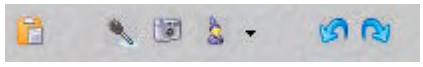
5.4 Image corrections

All correction tools are on one Correct tab: ▸

All essential image corrections fall into the following categories:

- White Balance (WB)
- Exposure and Tonality
- Color tuning
- Sharpness and detail
- Noise handling

The "Correct" toolbar:



From left to right:

- Apply settings to other selected images
- Activate WB gray balance tool (we use ⇧+Click instead)
- Set WB to "as shot" in camera"
- Auto WB and auto exposure. Auto exposure frequently provides a workable starting point (Alt-E)

Figure 5-35: RS Image correction tab

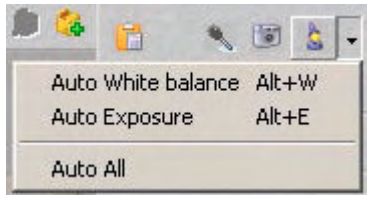


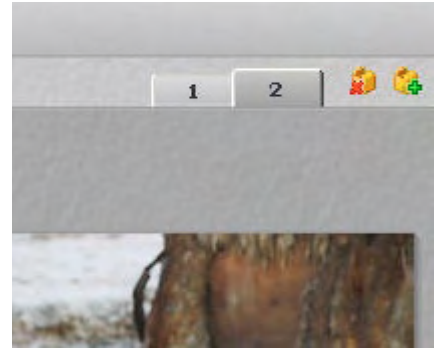
Figure 5-36: With RS, you may use "Auto White balance" as a good starting point.

- Back to initial settings
- Forward to last active settings

Since we have reached undo/redo features, it is appropriate to show a very powerful RS tool: **Snapshots**.

You can create as many snapshots as you like, and all those snapshot settings are stored for later use.

Note: RS stores all image settings in a subfolder with the name ".RWSettings" and all settings files appended with the suffix "*.rws".



Setting white balance (WB)

Figure 5-37: WB by Colder/Warmer *WB by color temperature*

White balance works as usual. The key correction methods are via color temperature or clicking on a light neutral gray object (do not use over-exposed white areas). The color temperature's default setting makes colors colder/warmer. You can change this in Preferences to sliders using absolute color temperature. We choose the default colder/warmer method because we believe that WB is, in most cases, a highly subjective decision.

We find that "as shot" WB is often satisfactory. We do like to photograph a gray card or Color Checker and use the gray balancing eyedropper. We are just overlooking some predefined and user WB presets.

Note: The navigator pane will show how the image would look if the WB eyedropper is clicked at the current position.

Exposure and tonality

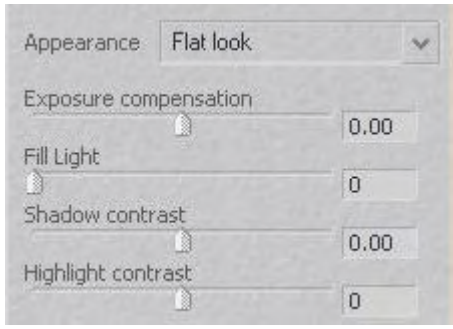


Figure 5-38: Adaptive controls in RS

Aside from WB, necessary for good colors exposure, tonality controls are essential in getting a pleasing photographic look to your images. RS has unique controls, and we had to learn how to use them. Most RAW converters support controls that, in principle, are a variant of levels and curves. RS works differently. It actually operates adaptively (pixels evaluated in their scene context, more like the Photoshop Shadow/Highlight tool). It may seem more complicated to describe than to actually experience yourself. To get the best from an image, you must find the optimum setting for all four sliders:

- Exposure compensation
- Fill Light
- Shadow contrast
- Highlight contrast

Keep in mind that it is best to make use of all four sliders and avoid extremes. Do a visual correction with RS displaying supporting histograms (3 types, click to change the display type):

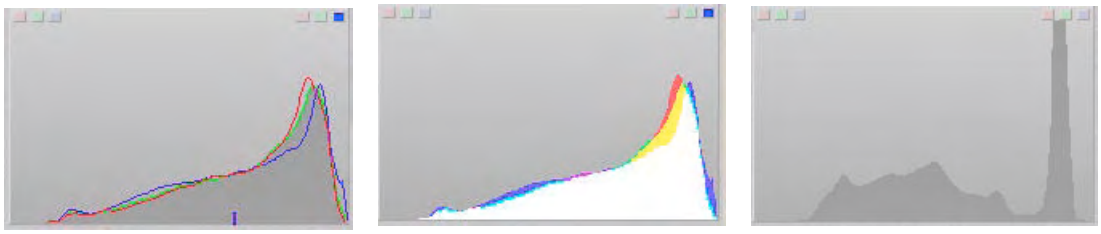


Figure 5-39: Watch your histogram while fiddling with the various sliders.

We like to use version #1. At the top you also find three indicators for highlights and shadows. They signal whether a certain channel is

being clipped. In the figure above, the blue channel is clipped in its highlights.

The best way to learn to use the controls is to play using your own images. We often see stunning improvements. The most accurate word to describe the results is: "more 3D like."

Here are some primary guidelines:

Note: All values are entered numerically. If you click the cursor in one of the fields, use the mouse scroll wheel for fine adjustments.

Exposure compensation (EV): If your image is too bright, tone down the EV. If too dark, first try Fill Light to brighten the image

Fill Light: For most images it is advisable to stay below a value of 50. Consider perhaps lowering the EV and then turn Fill Light up. Fill light also helps opening up shadows.

Shadow contrast: Usually best to tune up giving more depth and contrast (punch).

Highlight contrast: Used to tone down aggressive highlights.

Again these four sliders work hand-in-hand. Work with all of them.

Sample 1

Figure 5-40: Dull overcast shot (Canon 1D Mk. II)

The Fill Light feature is a key tool for working with your images.

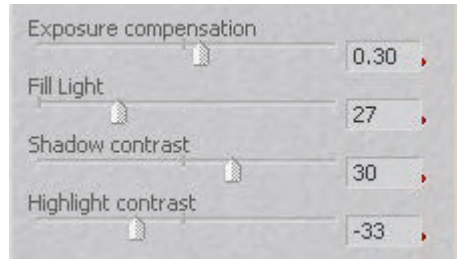


Figure 5-41: ▸ RS settings for tonality

Figure 5-42: Resulting image

Sample 2

Figure 5-43: Typical shot with deep shadows (Canon 1Ds Mk. II)

Before using RS, we spent much time achieving the correct tonality for this image (both in the RAW converter and later by masking in Photoshop). Using RS, it took us about 30 seconds (actually!).

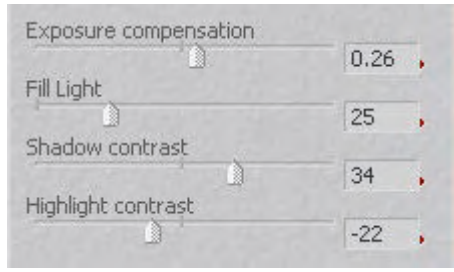


Figure 5-44: Corrections

Figure 5-45: Corrected

Sample 3

Figure 46: Over-exposed Canon 1D Mk II shot

We hope our corrected photo explains why we wanted to take the picture in the first place.

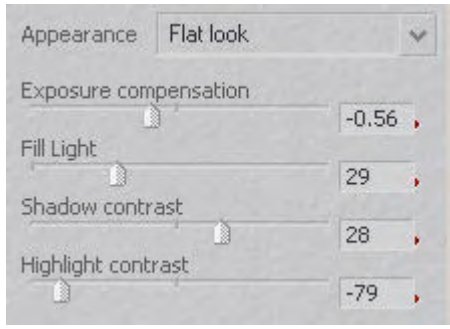


Figure 5-47: ▸ Corrections

Figure 5-48: Corrected

Saturation and Hue

Here you can do minor saturation and hue tweaking. Usually we set both sliders to zero.

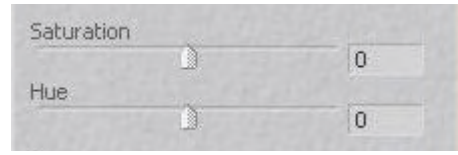


Figure 5-49: Saturation + Hue

Note: These tools, sharpening and noise removal, are best used at a magnification of 100% or greater. This is why the sliders are grayed out at lower values (though they are still fully effective).

Sharpness and Detail

It is hard to know how RS reaches its level of very natural sharpness. Both top-of-the-class debayering (demosaicing) and normal sharpening are involved.

Figure 5-50: Sharpness + Detail

Sharpening: slider normally left at 0. Zero does not mean that RS does not sharpen at all, but this level is considered to deliver a very natural sharpness with few sharpening artifacts. We set RS at level 0 and do necessary final minor sharpening in Photoshop using either USM (Unsharp masking) or EasyS.

Detail extraction: This allows the user to set the RS bias for fine detail or noise. The finer detail you select, the more fine noise will be undetected and vice-versa.

Here is a sample comparison to our previous favorite of detail rendering, Capture One:

Figure 5-51: Full 1Ds image 70–200 mm f/2.8 lens, tripod, mirror lockup

Figure 5-52: 100 % magnification with C1 + strong EasyS sharpening

Figure 5-53: 100 % magnification with RS + very light EasyS sharpening

It is amazing how images appear coming directly from RS with sharpening level set to 0 (we again remind you that this does not mean there was no sharpening). Images do seem to have a more 3D and natural look.

Noise reduction

Actually removing noise is easy. We hear you yelling :-). However, removing noise AND keeping detail is the real challenge. Even more difficult, is doing noise removal in near real time.

Honestly, we have not played enough with RS for a final judgment. Also, we do not use many high ISO shots. Still, RS may be the first RAW converter that is good enough for most of our photos without third party noise removal tools.

The developers of RS have invested a lot of work into noise removal since their tonality feature allows brightening shadows quite a lot. This operation is also pulling out noise, which is found primarily in the shadows. Opening up shadows usually needs effective noise removal. The two sliders provided deal with the two most common types of noise:

- Luminance noise
- Shadow noise

We use the noise removal tool in our sample session below.

Figure 5-54: RS noise reduction

Batch processing

When all parameters are set, add the image to the batch queue. Processing is done in the background while you work on the next image.

At any time you can view the batch queue and add, stop or remove batch jobs.

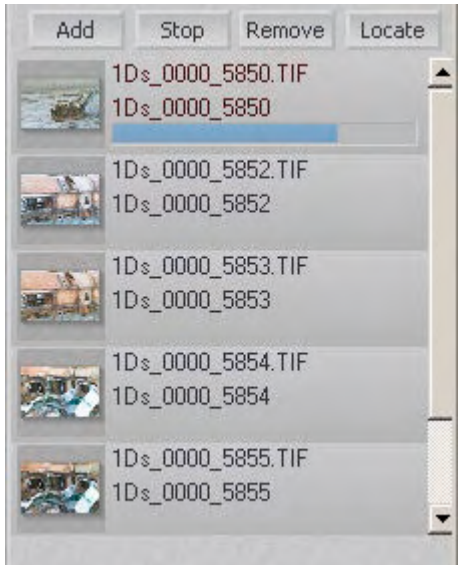


Figure 5–55: RS image batch queue

Slide show

Another nice feature in RS is: A slide show. The slide show is useful for two purposes:

- To simply view your pictures
- To set priorities and for tagging files for deletion

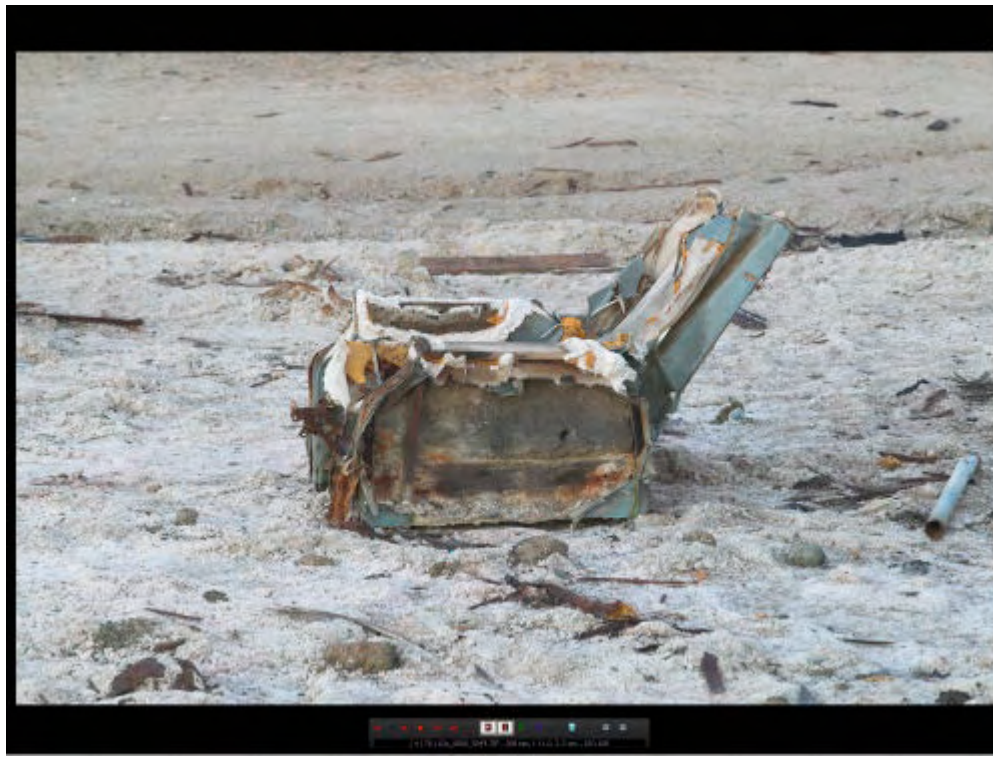


Figure 5-56: Slide show

Figure 5-57: Controls

The slide show may be the best way for an initial preview of your images.

Note: It is preferable to wait until all previews for a folder are created before generating the slide show as this process can be very slow if you try to do both simultaneously.

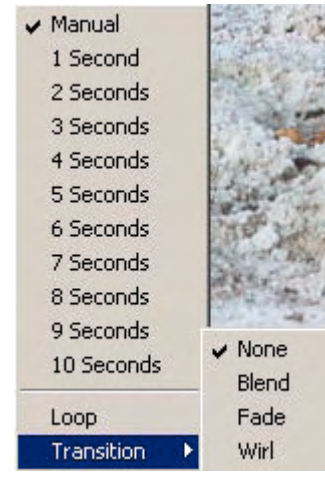


Figure 5-58: Timing and transitions

5.5 Advanced image corrections

Although RawShooter is still quite young, and until now focuses on basic conversion functionality, there already exist quite a variety of advanced image corrections. Expect to see even more in upcoming versions of RS.

Noise (luminance and color noise) ▸ Noise suppression in RS works quite well. You may not need specialized noise removal tools.

Sharpening ▸ For optimal sharpening, we use some sharpening in RS and still more later with other tools in Photoshop (Smart Sharpen or EasyS Sharpening Toolkit).

Removal of chromatic aberrations (CA) ▸ No correction of chromatic aberrations are offered with RS 1.1.

Vignetting ▸ No correction of vignetting is supported with RS 1.1.

Cropping ▸ RS (as of version 1.1) does not offer cropping, so any cropping can be accomplished in Photoshop.

Correcting tilt ▸ No tilt correction is offered with RS 1.1.

Perspective corrections ▸ No perspective correction is offered with RS 1.1.

Dust removal ▸ There is no provision for dust removal in RS 1.1. Dust removal, thus, is best performed with the Photoshop Healing Brush.

Upsampling ▸ No up or down sampling is supported with RS 1.1.

5.6 Extra workflow support

Batch conversion ▸ you may convert any selection of images at any time in the background.

Background processing ▸ RawShooter processes all conversions in the background. This is very convenient when working on a large number of images. It, however, slows down your foreground processing a bit.

Apply settings from one file to other files ▸ This may be easily done (see our Batch Processing chapter 8 for more information).

Snapshots for different conversion settings ▸ A very powerful feature of RS is Snapshots. You can save the current settings by creating a new snapshot. Snapshots are permanently stored with your settings.

Save/restore settings ▸ You may save your current settings, load them again and reset to RS defaults.

Camera default settings ▸ RS allows defining default correction settings on a per camera model basis.

Undo / redo ▸ Snapshots allow you to go to and fro – from current settings to previous settings.

Keyboard shortcuts ▸ For crucial and often-performed operations, keyboard shortcuts can save a lot of time. All shortcuts we introduce here are important. Check your manual for others.

Support for scroll wheel ▸ Click in any numeric field and use the scroll wheel on your mouse for fine-tuning.

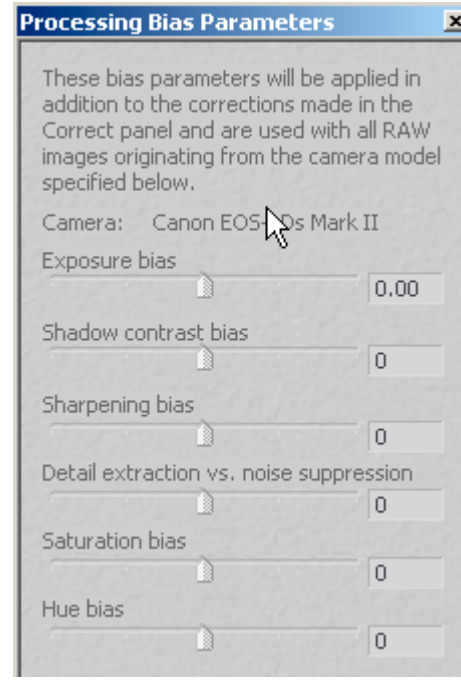

Processing Bias Parameters
These bias parameters will be applied in addition to the corrections made in the Correct panel and are used with all RAW images originating from the camera model specified below.
Camera: Canon EOS-1Ds Mark II
Exposure bias
0.00
Shadow contrast bias
0
Sharpening bias
0
Detail extraction vs. noise suppression
0
Saturation bias
0
Hue bias
0

Figure 5-59: Processing Bias

RGB value samplers ▸ RS has one color sampler that can be set to show the RGB value of the pixel below the mouse cursor during the editing of a single image.

Intentionally left blank

Chapter 6

More RAW Converters

Camera: Canon 1DS Mk. II

By previously digging deeper into the details of Adobe Camera Raw and RawShooter, we will shorten our description of those additional RAW converters. In so doing, we are not judging them less valuable. In his chapter, we describe the main features and some specialities of these converters.

6.1 Phase One's Capture One DSLR (Capture One)

Capture One Pro by Phase One ([20]) has been available for some time and has a generally good reputation. The company is well known for its **P-series** of digital camera backs for medium format cameras, such as the Mamiya RZ0 or Hasselblad 6 x 6.

We use Capture One DSLR Pro when working with our Canon 1Ds, 10D and Nikon D1x, D100 and use Capture One Rebel with the Canon 300D. Capture One DSLR is available for Windows and Mac OS.

There are two main features making Capture One a state-of-the-art RAW converter:

- Excellent image quality
- Great RAW converter workflow
- broad range of supported digital cameras

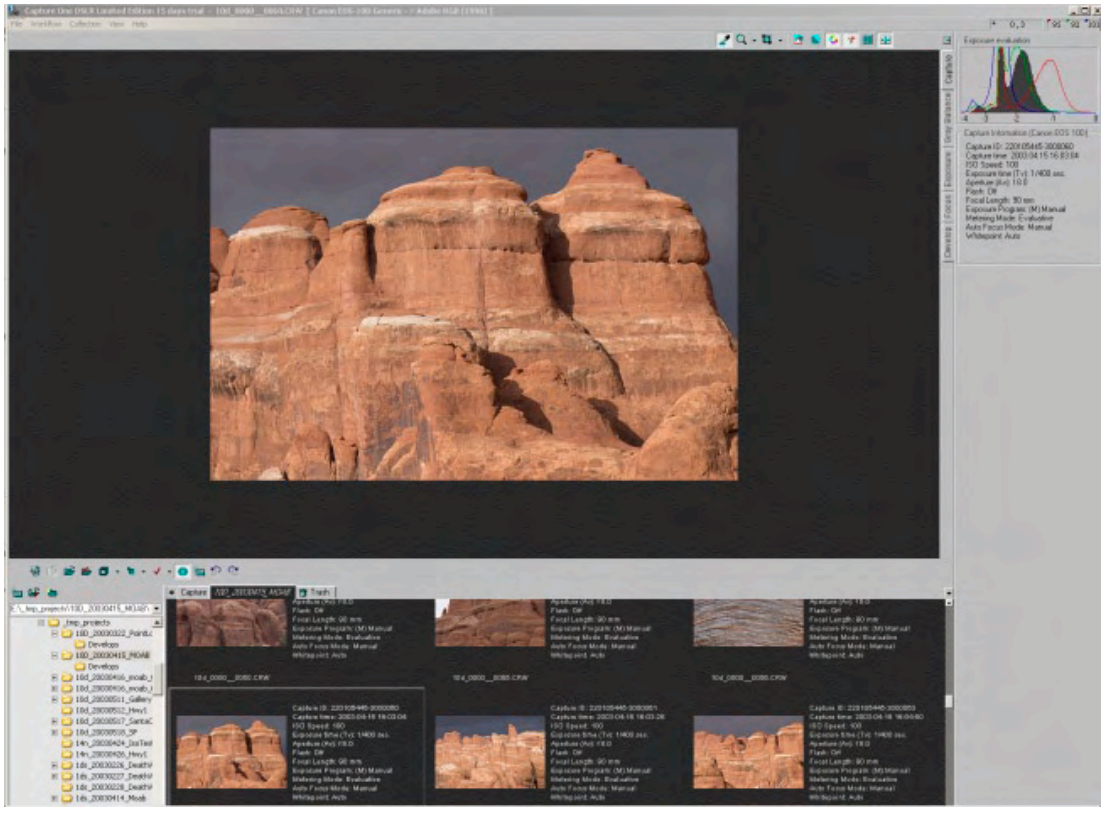


Figure 6-1: Capture One DSLR

There are various versions of Capture One (i.e. Capture One Pro and Capture One SE) each supporting unique function levels and different sets of cameras. Previously available LE version of Capture One has been discontinued.

Note: Some dialogs may differ, but is of little concern as we cover only those features used in our workflow.

Capture One is fully color management aware, an essential quality in doing any serious color work. The best way to appreciate Capture One is by learning how it works.

Capture One DSLR is what is called a "Full Service RAW Converter." This means you can accomplish nearly all operations on your final image inside this tool (one exception is retouching, such as cloning and lens & perspective corrections).

Note: Capture One DSLR RAW conversion is not based on the Canon or Nikon SDK. It uses its own algorithms utilized on their high-end digital backs for many years.

In fact, Capture One DSLR implements a highly-productive workflow for RAW files it supports.

We must remind you that this section is not intended to replace the manual, as we cover only the primary steps and settings. Capture One DSLR deserves a book of its own.

Capture One Setup

First, some help in setting up the preferences. We strongly recommend you take care to follow these essential settings:

- DSLR noise Suppression: our preference is to set this at low or medium/low for lower ISO images.
- Disable sharpening on output. Doing so simulates sharpening of the preview but does not apply sharpening to the output. We inspired this feature as we do sharpening later in Photoshop, but still wanted a preview that appears sharp.
- We disable opening of the developed image in Photoshop. Rather, these files are visible in the Photoshop file browser.
- Activate the separate RGB channels for a histogram.

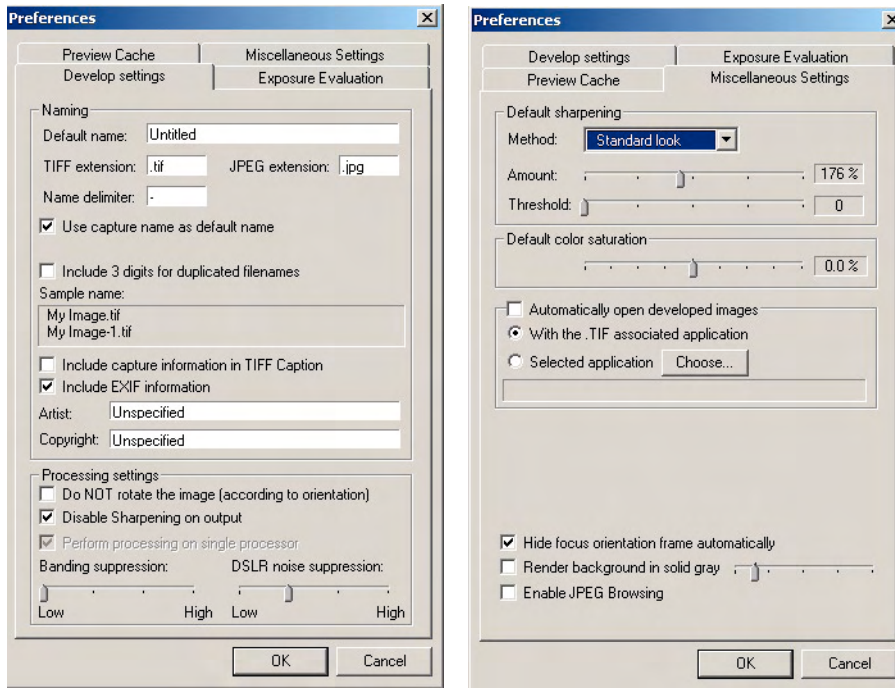


Figure 6-2: Setup of Preferences in Capture One DSLR

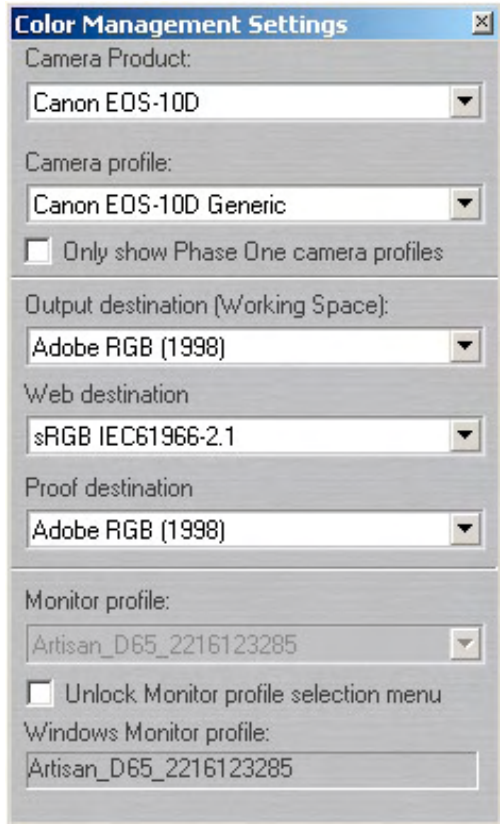


Figure 6-3: Capture One color management setup

- Camera Profile: Capture One offers generic profiles for supported cameras
- Working Space: We use Adobe RGB (1998).
- Monitor: At this time, enter your correct monitor profile (Capture One actually checks for a mismatch to the system monitor profile)

Capture One RAW file browser

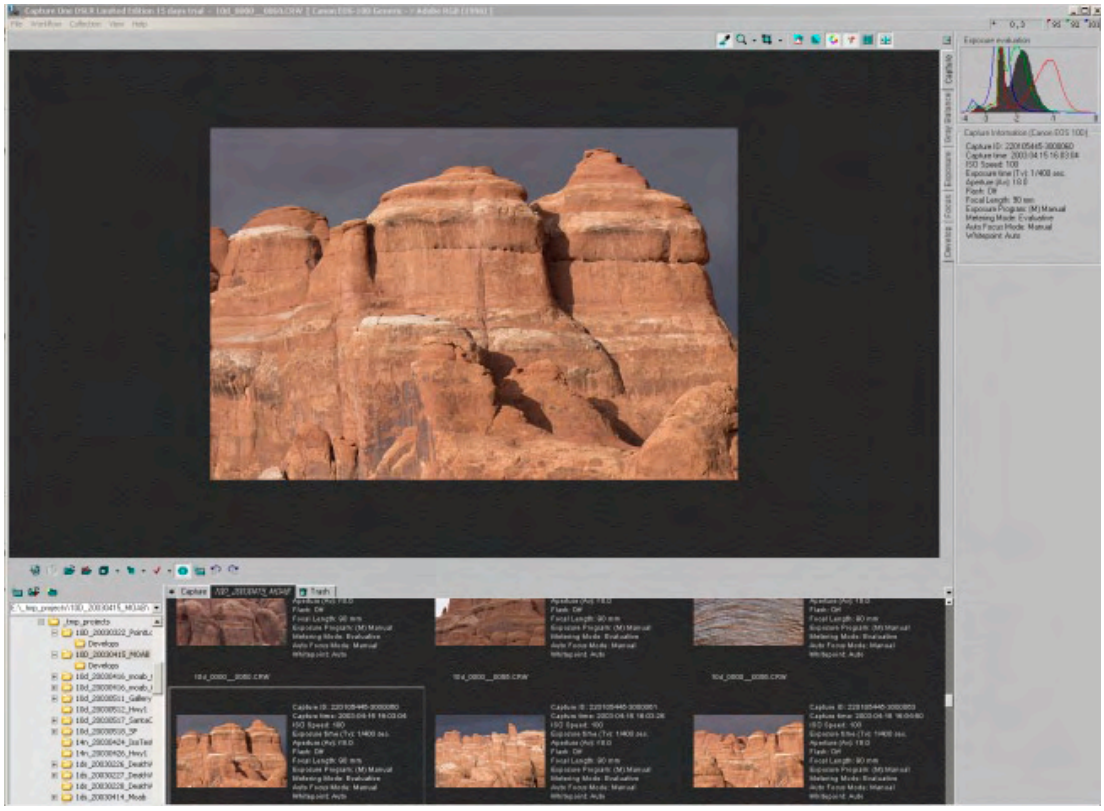


Figure 6-4: Image Browser in Landscape Mode

At first glance, the browser view appears as a nice but normal image browser. There are some major differences, however:

- By pressing function key F8, the browser toggles from portrait to landscape mode (allowing maximum space for preview image).
- Browser and Capture One do not use original RAW files for previews. Instead, Capture One creates its images in the background, and once these previews are created, you can switch

from one file to another in nearly real-time. The downside of this approach is the large disk space needed for the preview cache (It can be cleaned via the preferences dialog).

- Capture One allows users to define permanent project folders. Doing so simplifies accessing all current project folders quickly. The preview images in these permanent folders remain even after cleaning the cache.

Image Processing

Image processing in Capture One is a five-step workflow:

- Inspect
- Gray Balance your image
- Correct exposure and contrast
- Sharpen (called focus)
- Develop

Inspect

The first thing to do is to review photo and capture information, at:

- Histogram (best used with three-channel histograms)
- Data recorded by the camera, for example:
  - ISO
  - Exposure time and aperture
  - Lens used
  - Flash

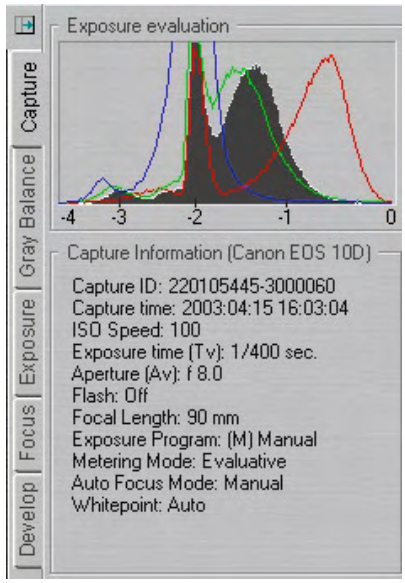


Figure 6-5: Capture tab of CO

Gray/White Balance (WB)

The main tool used for gray balancing is the eyedropper. Select a gray area within the image and click the eyedropper. Capture One helps by giving you hints as to whether this is the best spot for gray correction.

If no gray exists in the image, things can get a bit more complicated. In such case, it is suggested you use the color temperature controls (Color Temperature and Tone Balance).

Best to have taken the shot with a gray card or Color Checker (we have one with us at all times) using the same light. Makes gray balancing much easier. Capture One also allows additional cast corrections.

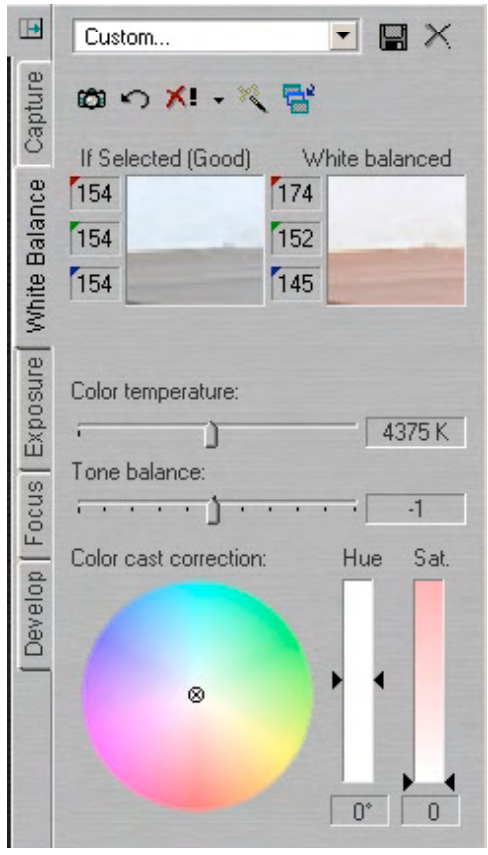


Figure 6-6:
Capture One's Gray Balance tool

Since you can save/restore WB settings, you can also save some sample settings for the same light conditions.

Capture One provides automatic correction. As in all automatic corrections, results may not be optimal. Try and decide for yourself.

Exposure

After white balance, exposure is the next most important correction tool. Here, you can correct ±2.5 EV. The histogram and preview image (use this option in the toolbar) let you inspect all areas of over-/under-exposure. Especially important are the RGB channel histograms as there are often over-exposures in only one of the channels.

Besides EV, you may correct contrast and tweak saturation (try to maintain moderation).

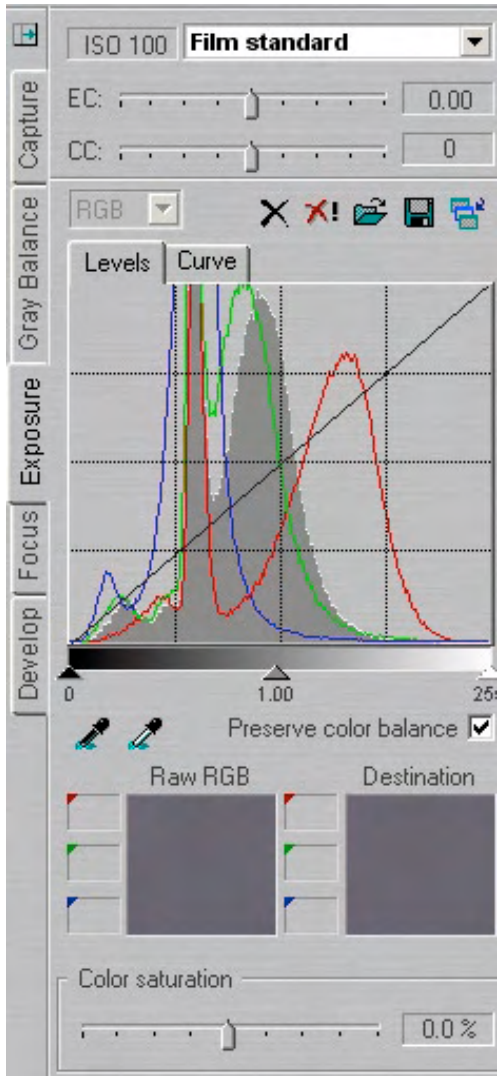


Figure 6-7: Capture One Exposure

Tone Curves

In addition, Capture One includes a variety of tone curves:

Figure 6-8: Capture One offers some predefined tone curves

For most situations, the standard tone curve *Film Standard* will do. When requiring greater shadow detail, try *Film extra Shadow*. The curve *Linear Response* is used mainly for profiling purposes.

More and more often we find Curves in Capture One to be useful, especially in recovering some shadow detail. Otherwise we leave shadow recovery to Photoshop.

Focus and Sharpening

The Capture One sharpening tool is a classic Unsharp Mask (USM). Refrain from over- sharpening your images.

As mentioned earlier, we leave our own sharpening until later in the workflow process.

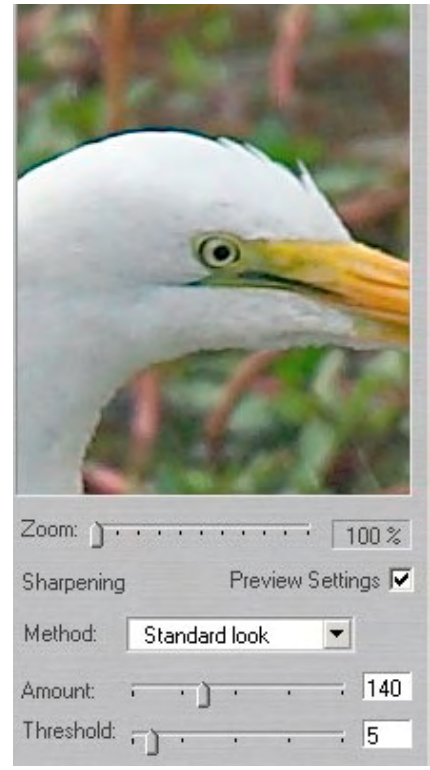


Figure 6-9: ▸
Capture One Focus tab

Develop tab

Clicking the Develop button (or the Insert key while you are viewing any tab) a real RAW conversion is performed. Once again, Capture One demonstrates its focus on workflow. Here's how? RAW processing is done in the background, and Capture One is free for the further interactive image corrections.

Note: Capture One LE can have only a limited number of files for development at any time. We work around this limitation by working on developed files in Photoshop. Then we add more to the queue. If this is a problem for you, you are a real pro. Buying the Pro version might save time and money.

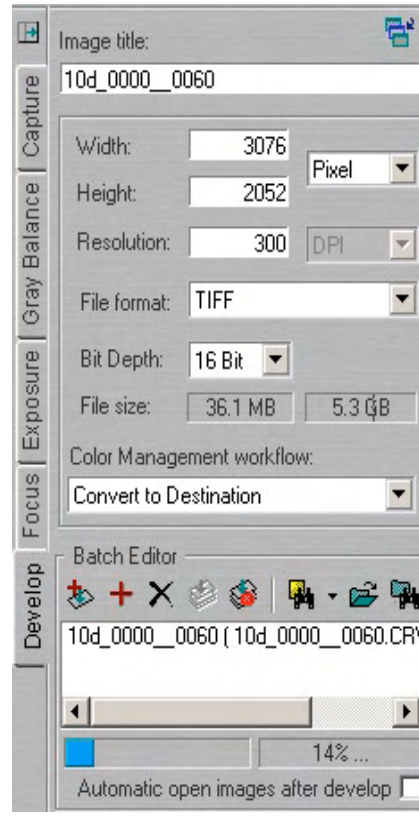


Figure 6-10: ▸
Capture One Develop tab

What's More?

There much more to Capture One. In our personal workflow, we are quite pleased with the basic functionality as outlined. Studying the Capture One help file is well worth the time.

- You are able to create custom camera profiles and use them in Capture One.
- Export preview images

Note: There are available third party profiles for Capture One. They can make a significant difference in your work.

Because we use so many different cameras and RAW converters we try to keep to the basics, which are:

- Get the white balance right
- Optimize Exposure

6.2 Bibble version 4 (B4)

We have used Bibble for more than 4 years. Unfortunately the previous version, Bibble 3, had not been updated for some time. Eric Hyman, Bibble's author (Bibble is his cat's name) took his time and created a completely new version 4. We suggest it was worth the wait. Bibble 4 supports most digital SLRs available as well as some digicams, and runs on Windows and Mac OS. Bibble's goal is to provide satisfactory image quality along with excellent workflow.

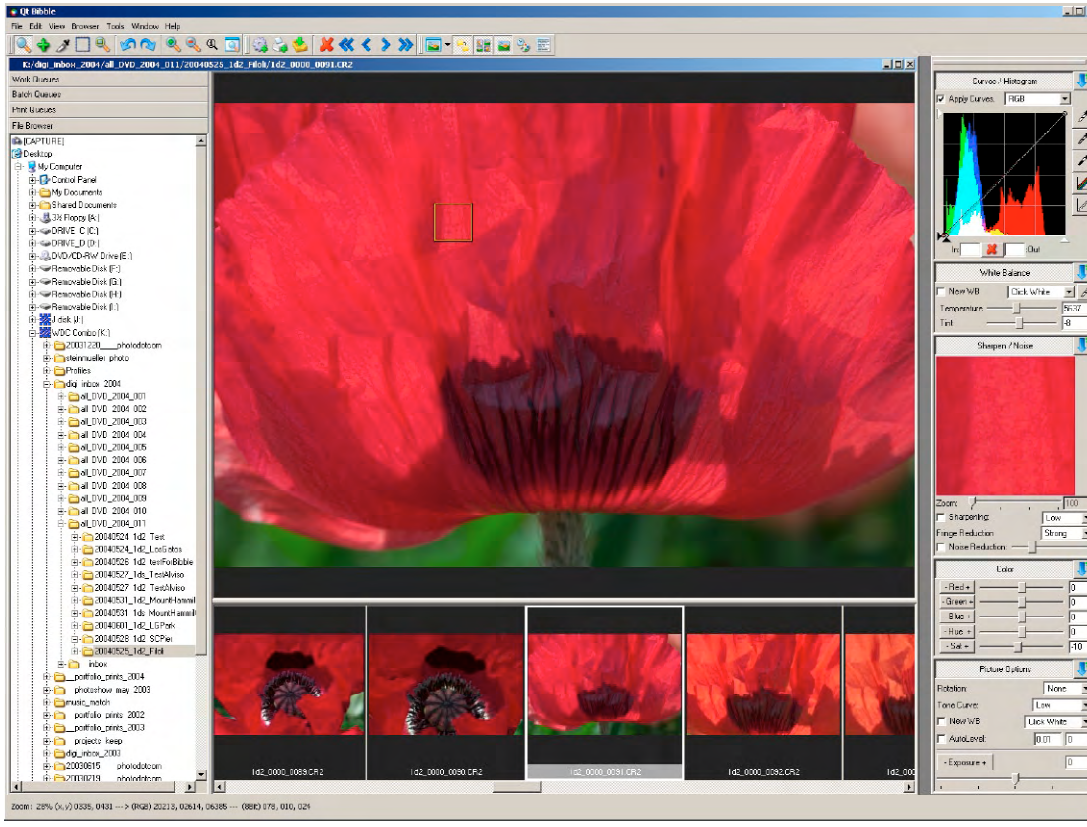


Figure 4-11: Main window of Bibble 4 (Windows version)

The Bibble user interface is highly customizable. We show here the interface we use (thumbnails in filmstrip-mode).

Bibble Setup

Preferences

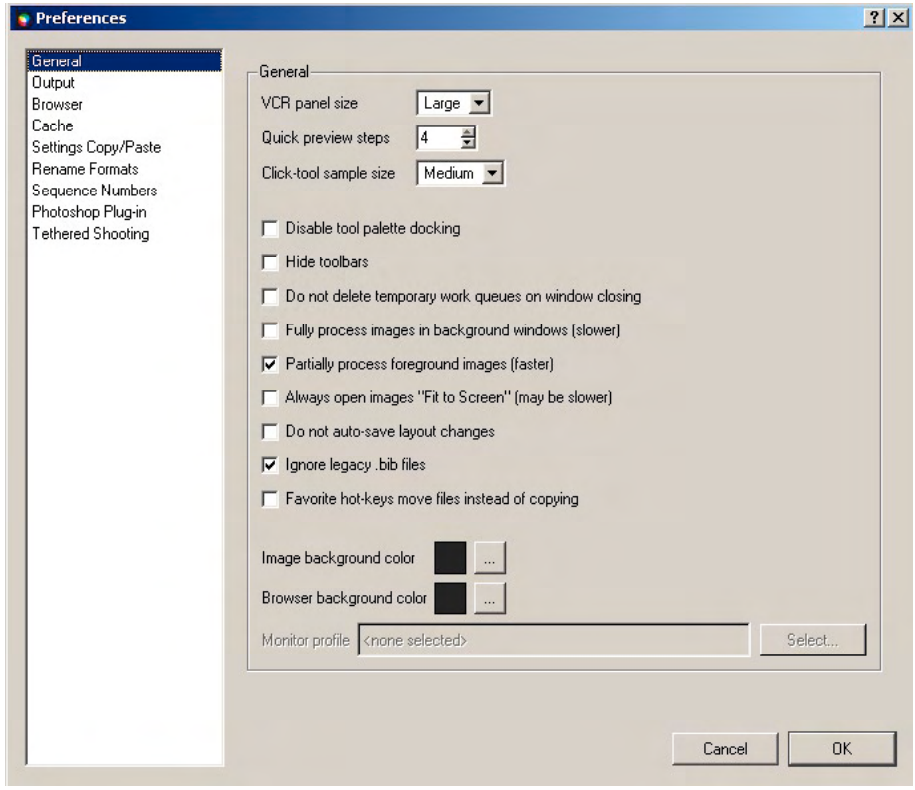


Figure 6-12: Setup of Preferences in Bibble 4.x

We recommend unchecking the Fit to screen option, speeding up workflow significantly.

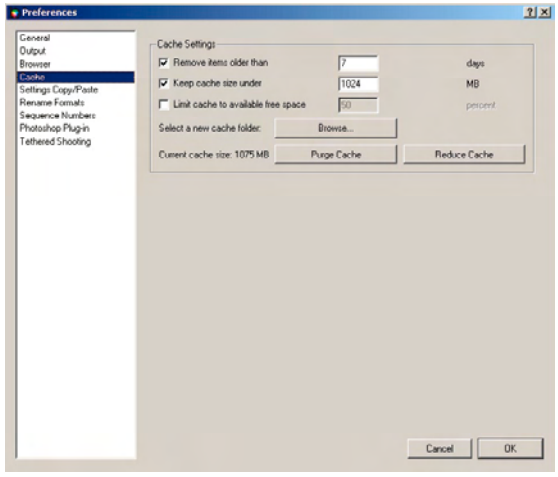


Figure 6-13: Setup

There are a couple of things requiring setup. We recommend using a cache folder to store lots of data (at least 1 GB). For other setting, refer to the help.

Color management

Bibble is fully color managed. You may add your own custom profiles and, moreover, change settings on an image-by-image basis.

Figure 6-14: Bibble Color Management Setup

Main features of Bibble 4.x

As with Adobe Bridge, Bibble is highly customizable. When browsing a folder we suggest use of the following view setup:

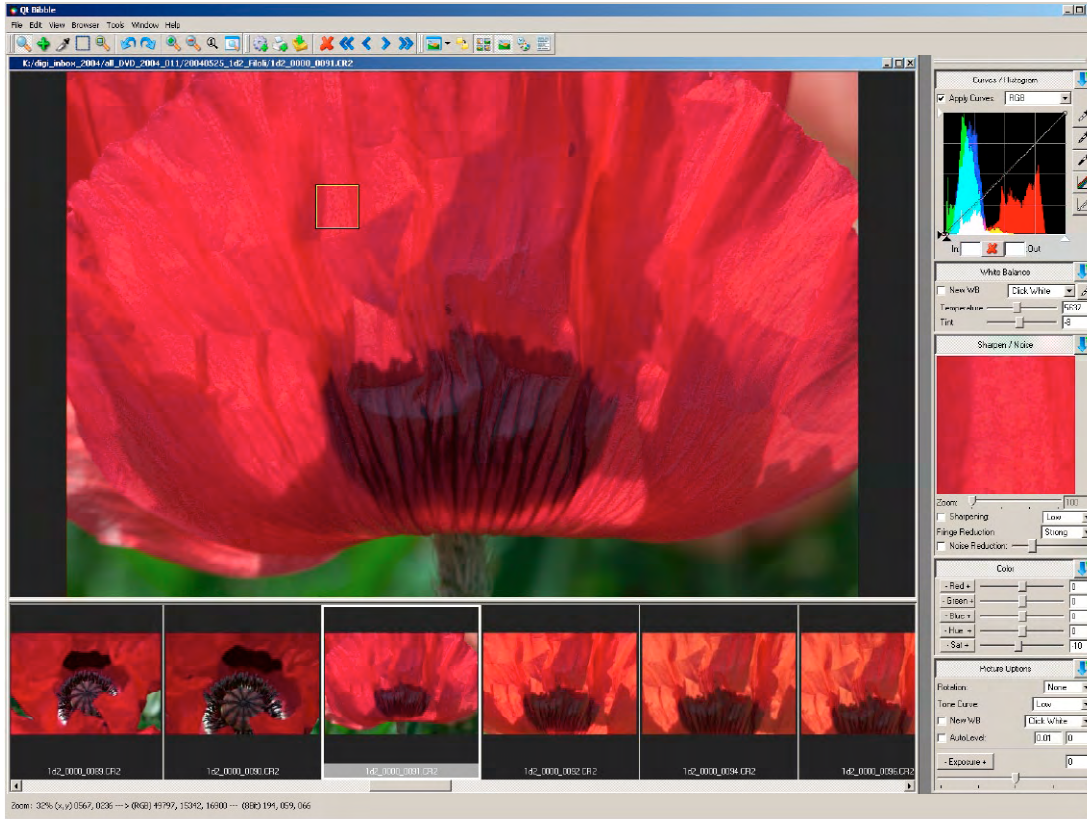


Figure 6-15: Bibble 4.x multi-image view

Bibble 4 supports all tools needed for an efficient RAW conversion (it works on JPEGs, too).

- Picture Options (holds crucial parameters)
- White Balance (WB)
- Curves/Histogram
- Sharpen/Noise
- Color and color management

White balance (WB)

Apart from correct exposure, the second most important task in Bibble 4 is correcting white balance (WB). Two ways exist to accomplish this:

- by setting color temperature – using either the slider Temperature or by selecting one of the presets via the pull-down menu.
- by selecting a point that should be neutral gray using the .

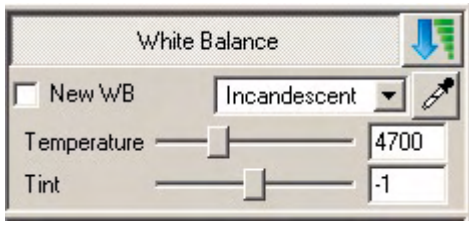
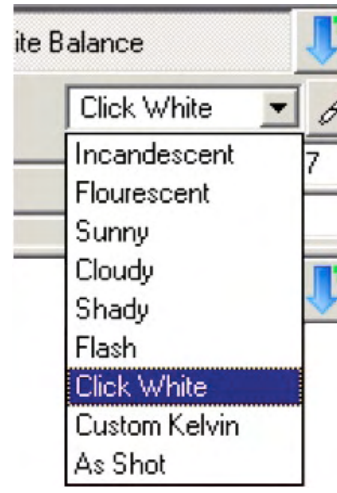


Figure 6-16: WB: Setting Color Temperature



Color Temperature Presets

Normally, we are more interested in a pleasing subjective color temperature than absolutely accurate color values. Our photos seldom have well-defined gray areas enabling use of the eyedropper for a reference point for a white balance (see description at page 6–15).

Setting the Gray Point

Correcting WB by clicking on a gray area in the photo (e. g. a gray card or ColorChecker) with the eyedropper is the method of choice when you need the best objective WB correction and such gray area exists within your photo.

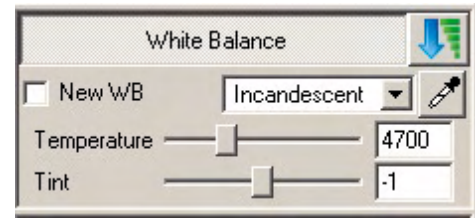


Figure 6-18: White balance

Picture Options

This is a crucial dialog – only the main controls are mentioned here:

- Exposure (EV)
- Tone Curves
- Auto levels

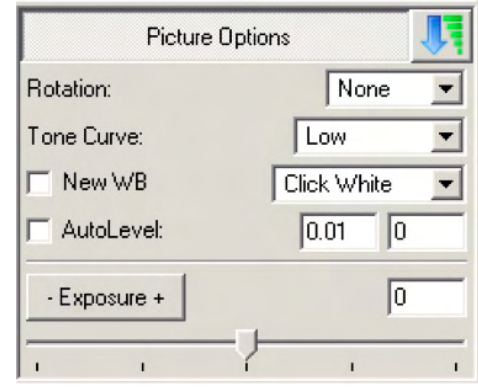


Figure 6-19: EV compensation

Make a habit, during EV correction, of very carefully watching the image and its histogram to avoid data clipping in the highlights and (or) shadows.

Bibble 4 tone curves are useful to adjust contrast:

The differences are subtle, but they can make a huge difference in tonality.

Auto levels can be acceptable or too strong. We leave highlight clipping always at zero (you can define default settings for new images). Sometimes, Auto Levels delivers the snap that you desire.

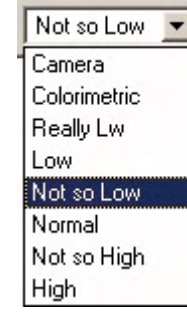
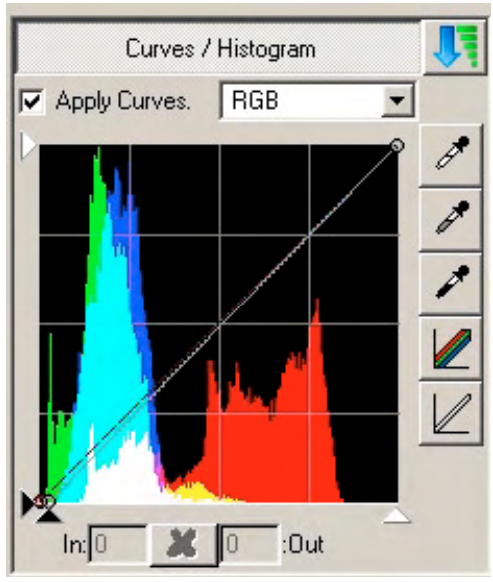


Figure 6-20: Predefined Tone curves

Tone curve adjustment (RGB tab)

Bibble 4 provides a powerful curves tool with a full RGB histogram.

Figure 6-19: Curve adjustment



Color adjustment (RGB tab)

Be cautious when using the hue slider. Using the saturation slider may make more sense. Most often we lower saturation rather than making it stronger. As explained in chapter 3, you should consider a more selective saturation enhancement and do it in Photoshop.

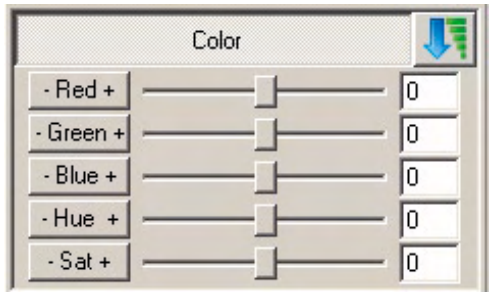


Figure 6-20: Color Rendering

Sharpening/Noise

As stated previously, we prefer to do sharpening in Photoshop using one of many sharpening tools available. Most frequently we use sharpening at level "low" or turn it off entirely.

Fringe Reduction is designed to lower fringes (mostly green or magenta) at high contrast edges. This helps keep artifacts down from chromatic aberration (CA). If your image displays fringes, you must

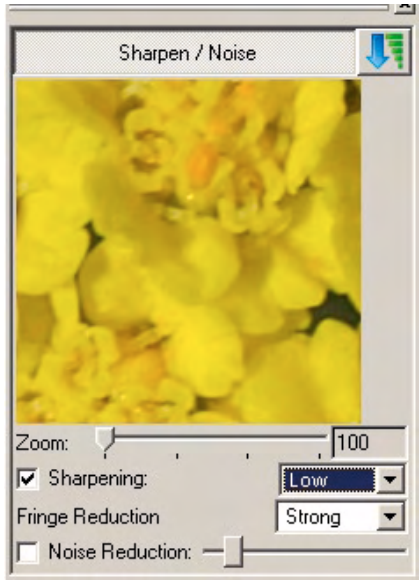


Figure 6-21: Sharpening/Noise

use high magnification to recognize them – do your fringe reduction here.

Normally we keep **noise reduction** "off" or set to a very low level. If your image clearly requires further noise removal, use a dedicated tool, such as Noise Ninja in Photoshop. Photoshop CS2 ships with a new noise reduction filter (see chapter 7.3 at page 7-9).

Workflow with Bibble 4

Bibble provides for a good workflow. Here are some elements that help with that:

- Fast thumbnail conversion
- Fast image preview
- Easy real-time image corrections
- Apply settings to other selected files
- Render images in the background.

Bibble 4 does an better than average job in all these areas.

Another handy feature of Bibble 4 is its so-called *Batch Queue*:
Figure 6-22 on page 6-18 shows our standard settings for running a conversion in the background and then launching the converted files into Photoshop. You may attach a keyboard letter to this batch queue (we used "P"). When you press 'P', the image gets converted in the background, the result launched into Photoshop. We have another queue attached to 'T', doing the same, but does not open the file in Photoshop.

This is been intended as a full description of all Bibble 4 features. Some of its other interesting features are:

- Work Queues: You can group files from different original folders into virtual groups then work with them as though they belong to the same folder. When working on a project, you can create different work queues and collect 'keeper' images in these queues by subject. You might, for example, have a queue each for:
  - Landscape
  - Wildflowers
  - Wildlife/Birds

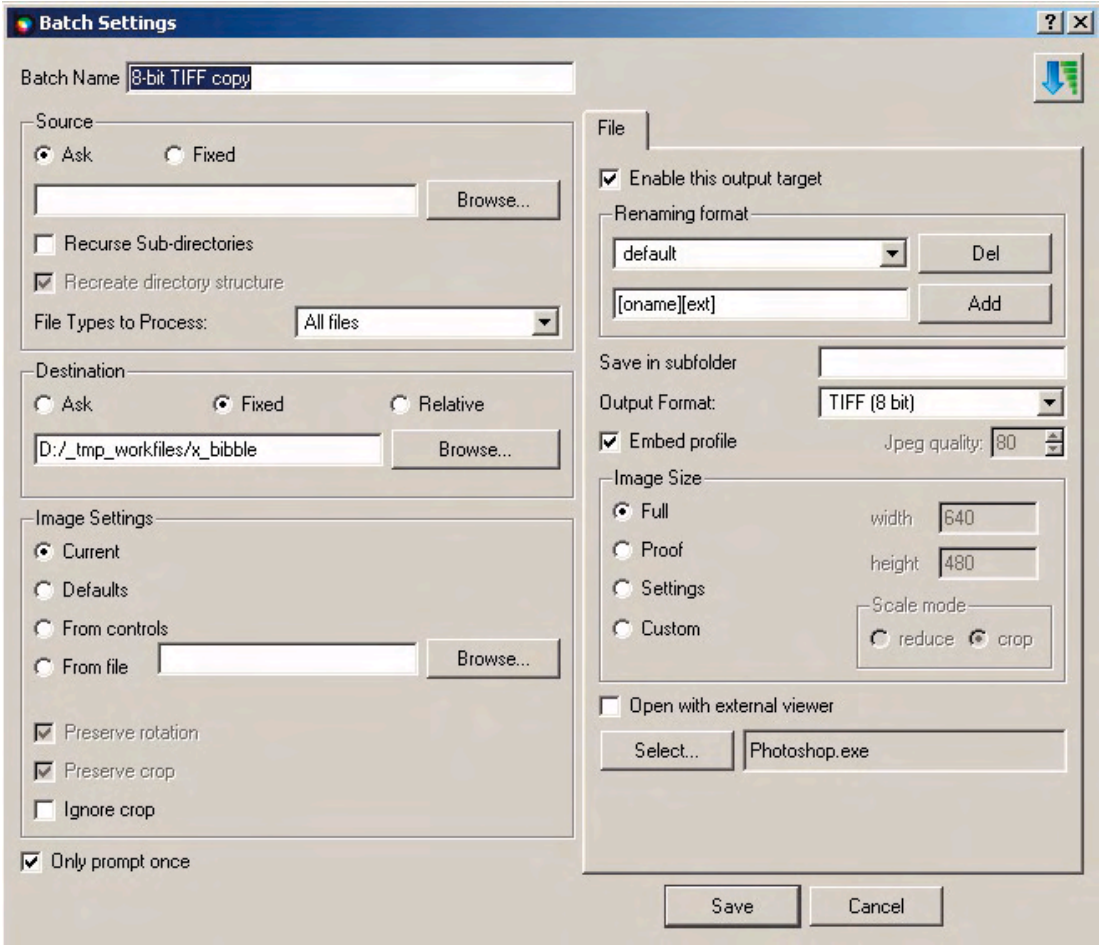


Figure 6-22: Batch Queue Settings

- Print Queues: We have not even used this, as yet, since we often print from either Photoshop, Qimage or Image Print.

6.3 Canon Digital Photo Professional (DPP)

Canon Digital Photo Professional (DPP for short) is a free tool that ships with the Canon high-end DSLRs: 1Ds, 1D and 1D Mark II (it is also designed to support future Canon digital SLRs). DPP is Canon's answer to third party tools that are much stronger in terms of workflow than its past Canon tool.

Conversion quality is good, and also its workflow is adequate. It runs under Windows and Mac OS. DPP is not quite as elegant to use as ACR, Capture One or Bibble 4.

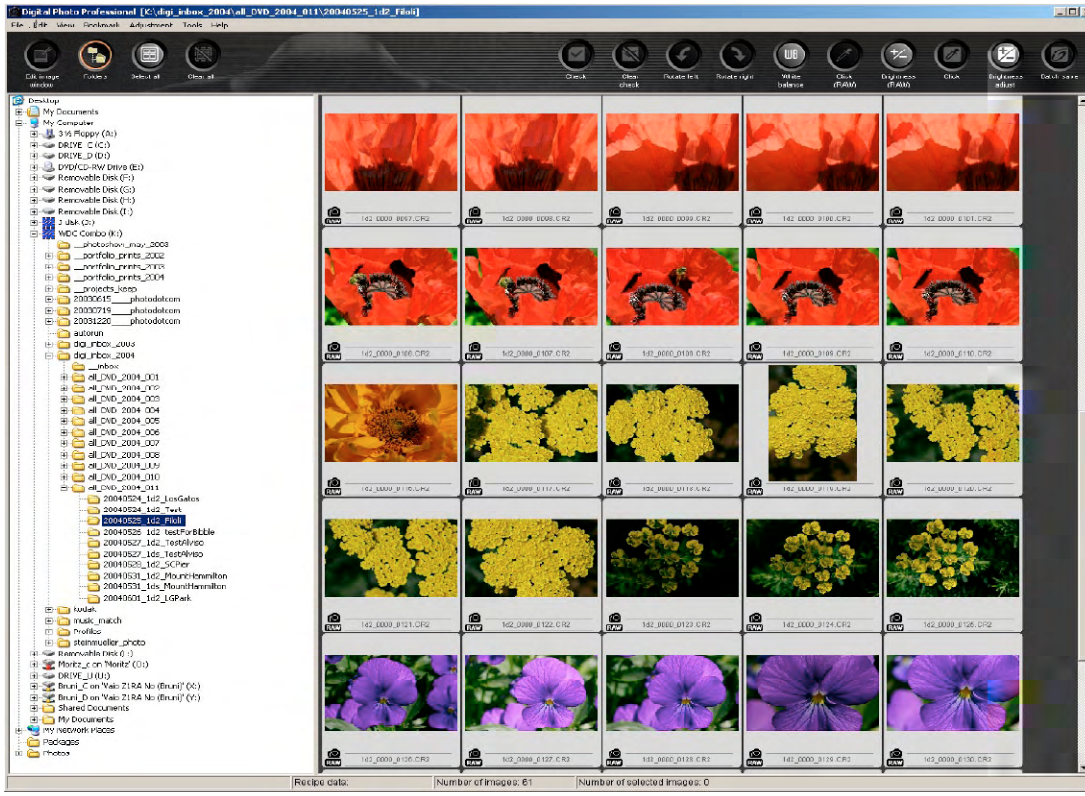


Figure 6-23: Canon Digital Photo Professional

Setup

Preferences

With DPP, we consider Operating Mode as one of the most important settings. *Standard* is the best compromise of working speed to output quality (same quality on output as "Quality Priority").

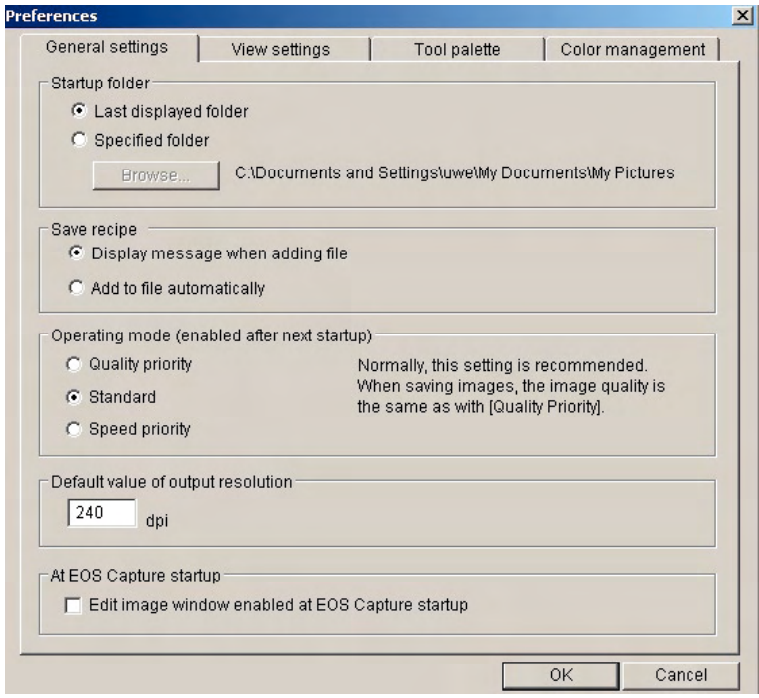


Figure 6-24: "General settings" tab in DPP Preferences

Color management setup

DPP does not detect a system monitor profile automatically, but allows selecting it manually. This is essential in achieving an accurate color preview on your monitor.

As working space we use "Adobe RGB," as with all tools.

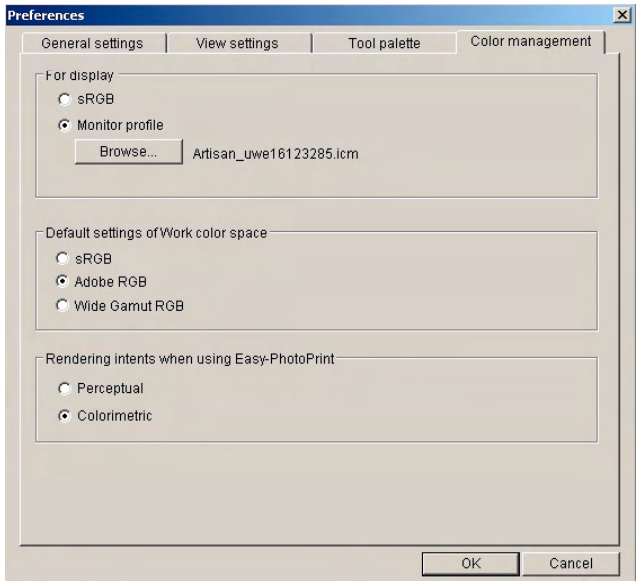


Figure 6-25: ▸ Color Management

DPP – main features

There are four types of windows used when working with DPP:

- Main Window: for browsing thumbnails (see figure 6-26)
- Image Editing Window: Editing selected RAW files
- Single-image editing window (see figure 6-27)
- A panel with settings for the RAW conversion (see figure 6-29)

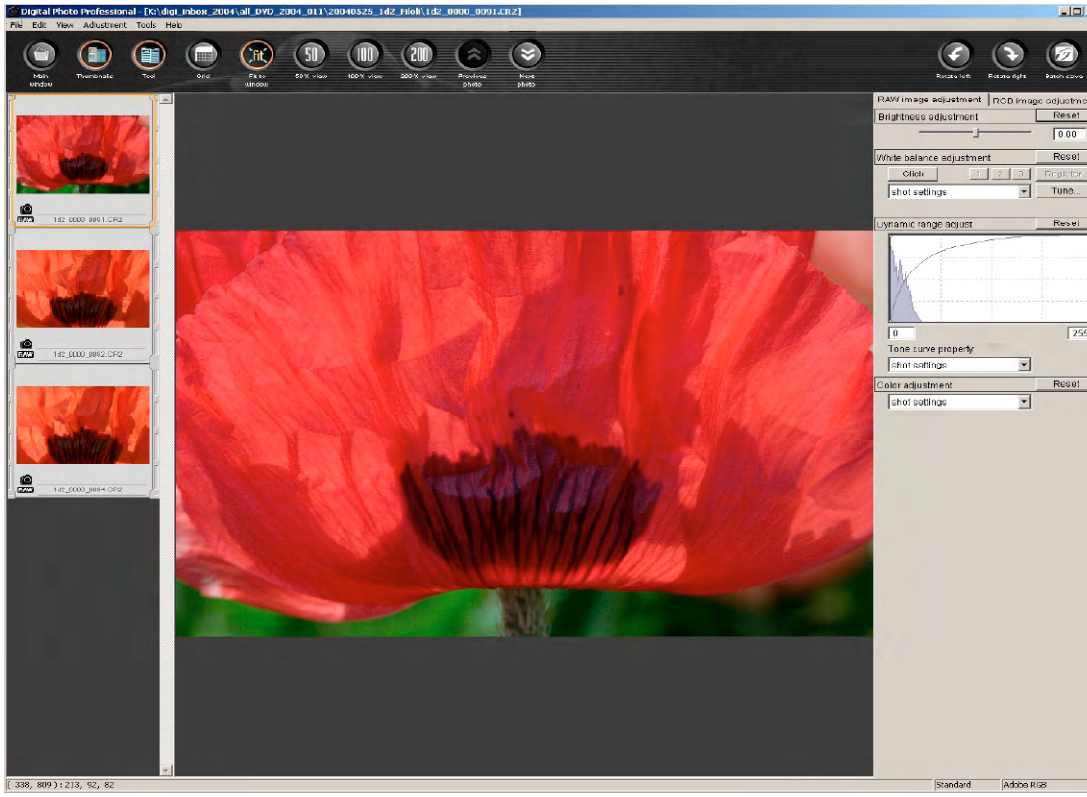


Figure 6-26: Edit Image Window

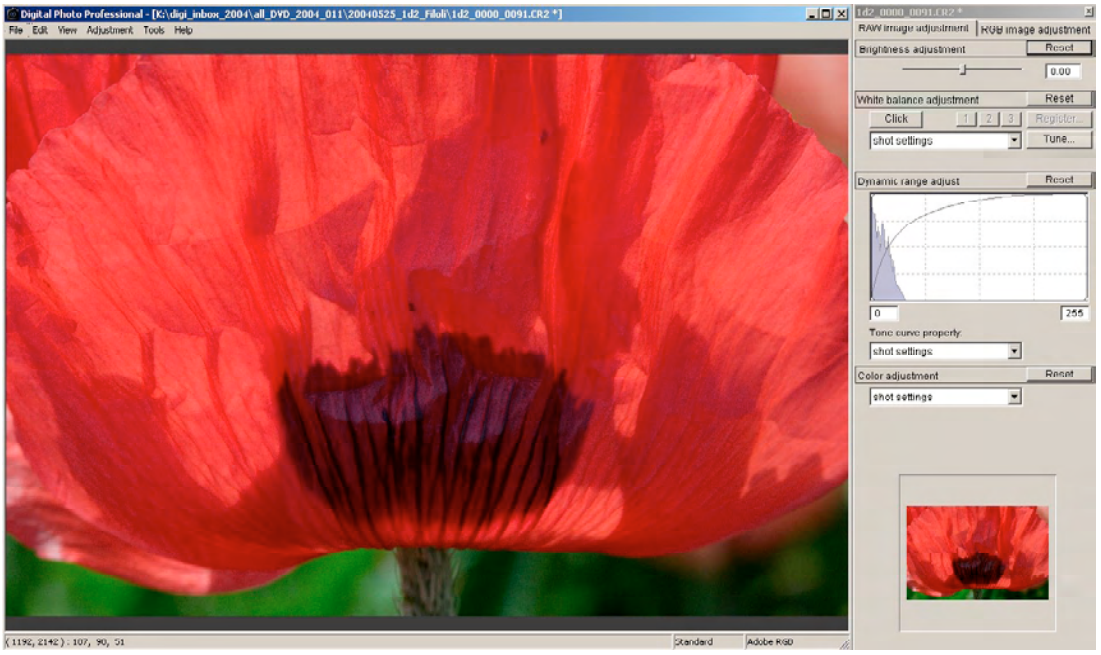
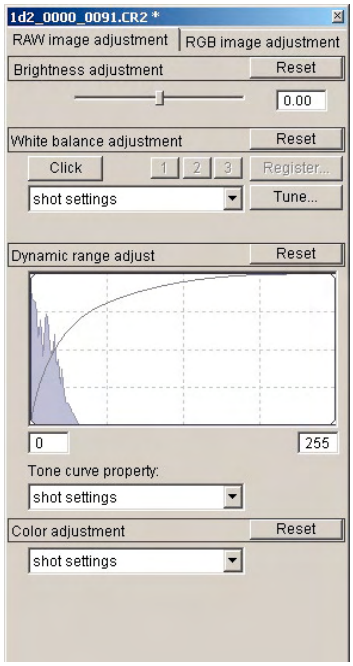
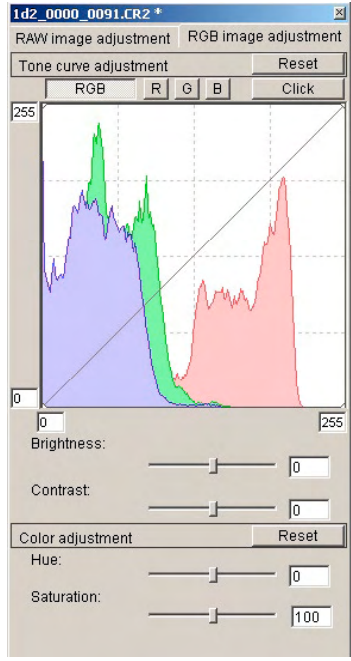


Figure 6-27: Singe Image Editing Window

The tools necessary to correct and optimize a RAW image are divided into two tool tabs:

- RAW image adjustment
- RGB image adjustment



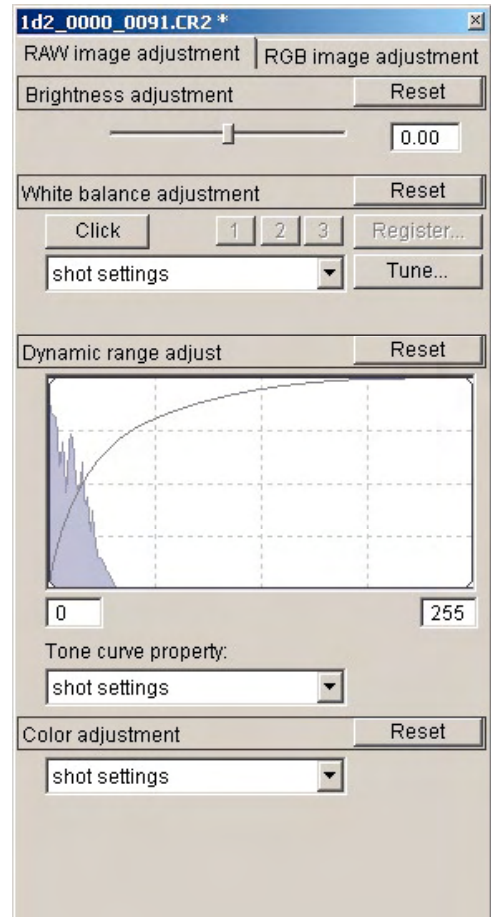


◂ *Figure 6-28: Bibble uses different tabs for RAW conversion and RGB handling.*

RAW image adjustment Panel

This panel contains key controls to adjust your RAW files:

- White Balance (WB)
- Brightness (EV)
- Color Adjustment
- Dynamic range adjustment (Tone curve)

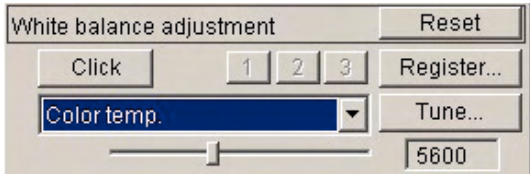


▲ *Figure 6-29: RAW Adjustment Panel*

White Balance (WB)

Other than EV, the second basic task in DPP is getting white balance (WB) correct. There are two ways to correct WB.

A) Setting the color temperature



▲ *Figure 4-30: WB: Setting Color Temperature*

When shooting nature photographs, we are often more interested in the subjective color temperature than absolute accurate color values. Our photos seldom have well-defined gray areas to use for method B (Figure 6-32).

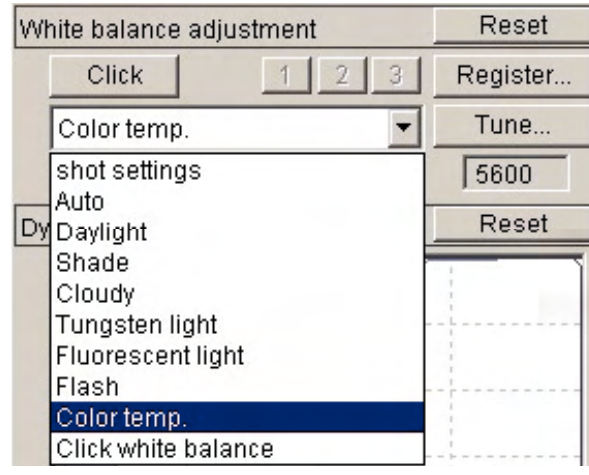


Figure 6-31: Color Temperature Presets

B) Setting the Gray Point

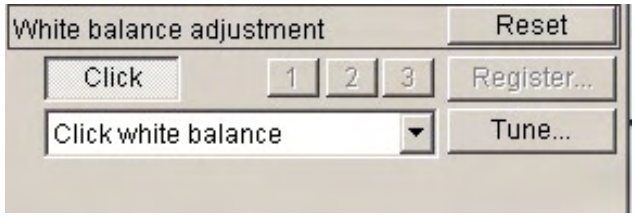


Figure 6-32: Setting WB Gray Point

Correcting WB by clicking on a gray object within the photo (e. g. a gray card or ColorChecker) is the method of choice to obtain the best objective WB correction when you have such a gray area inside your photo.

Setting Exposure

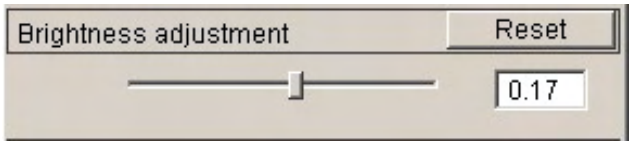


Figure 6-33: EV compensation

During EV correction, keep your eye on the image and histogram closely to avoid data clipping (both highlights and shadows). Sadly, the better-suited histogram is from the RGB adjustment tab as the histogram here appears to display linear data. Therefore, it is probably better to correct exposure by only viewing the image.

Color Rendering

Figure 6-34: Color Rendering

We leave this menu at "shot settings".

Tone Curve Adjustment (RGB Tab)

This is an extremely powerful curves tool. We have used all its controls to demonstrate its flexibility:

- Brightness
- Contrast
- All normal curves functions

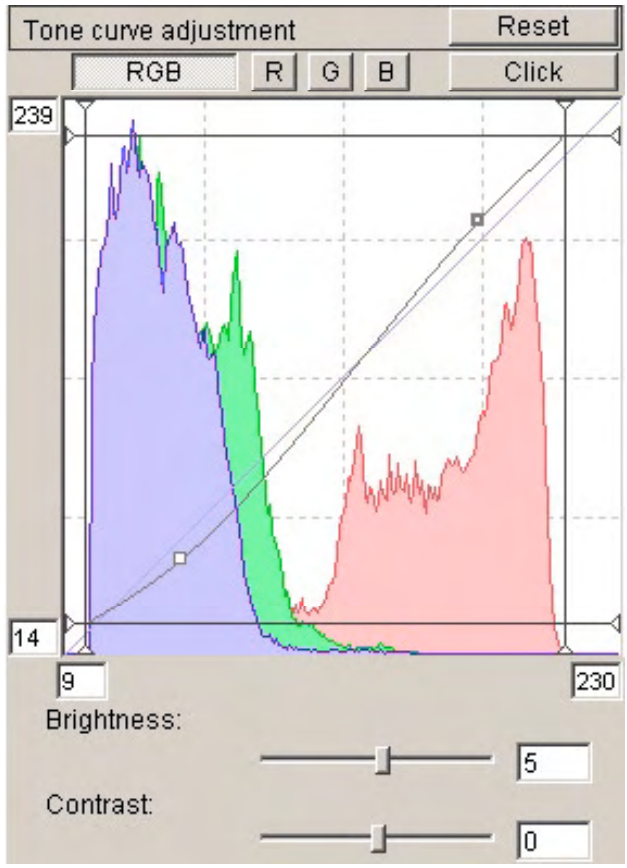


Figure 6-35: Tone curve adjustment

We always leave our image slightly 'soft', making final adjustments in PS using our layer-based workflow.

Color Adjustment (RGB Tab)

Be careful in using the hue slider. The saturation slider may make more sense. Often, we'd rather make saturation lower rather than stronger. As explained earlier in the workflow chapter, you should possibly consider a more selective saturation enhancement and then do it in Photoshop.

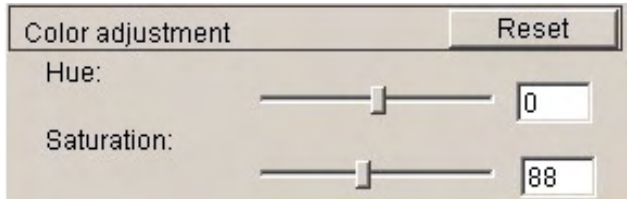


Figure 6-35: Color Adjustment

Saving converted files

DPP offers two ways to save converted files:

1. Single image save (don't forget to select "Embed ICC profile").

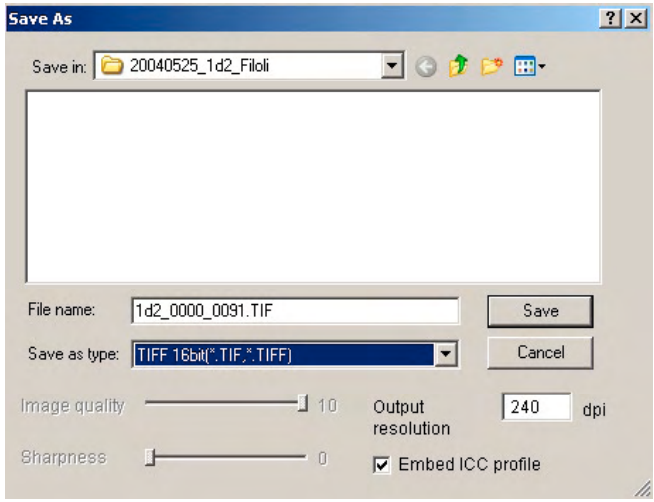


Figure 6-37a: Save converted file

2. Batch save

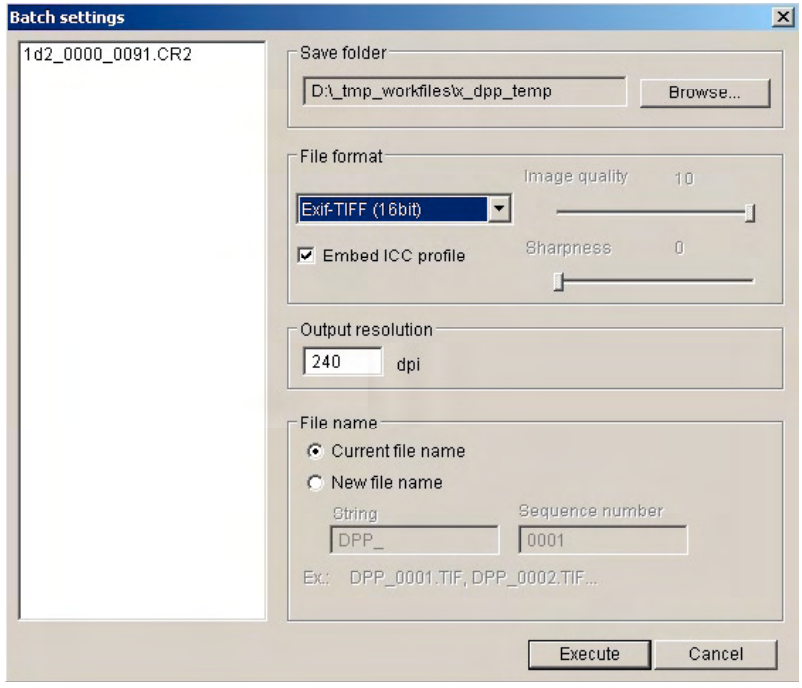


Figure 6-37b: Batch Save

We choose the second option because you are able to:

- Convert multiple files at one time
- Select a standard target folder
- Continue working on another file while conversion of the previous file is performed in the background.

When the images are processed, this dialog displays:

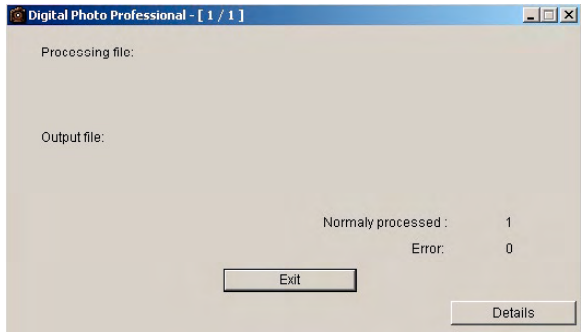


Figure 6-38: Processing dialog of DPP

Unfortunately, no option makes this window close by itself.

Bug (feature) in our current version (6/2/2004):

When an image already exists in the target folder, that image will not be processed. EVU would, in this case, use a different name (e. g. xxxx(2).tif)

6.4 Nikon Capture

Nikon Capture (NC for short) is Nikon's full-featured RAW conversion utility – available for Windows and Mac OS. It is used not only for RAW conversion, but for scanning with Nikon scanners and editing JPEG files, as well. Though it offers diverse image operations, it does not modify the original image, rather, stores all operations as a command sequence. Thus, you may undo or modify at any time these operations without a loss of quality (much the same as other RAW converters). Nikon Capture, however, does not substitute as an image editor, such as Photoshop.

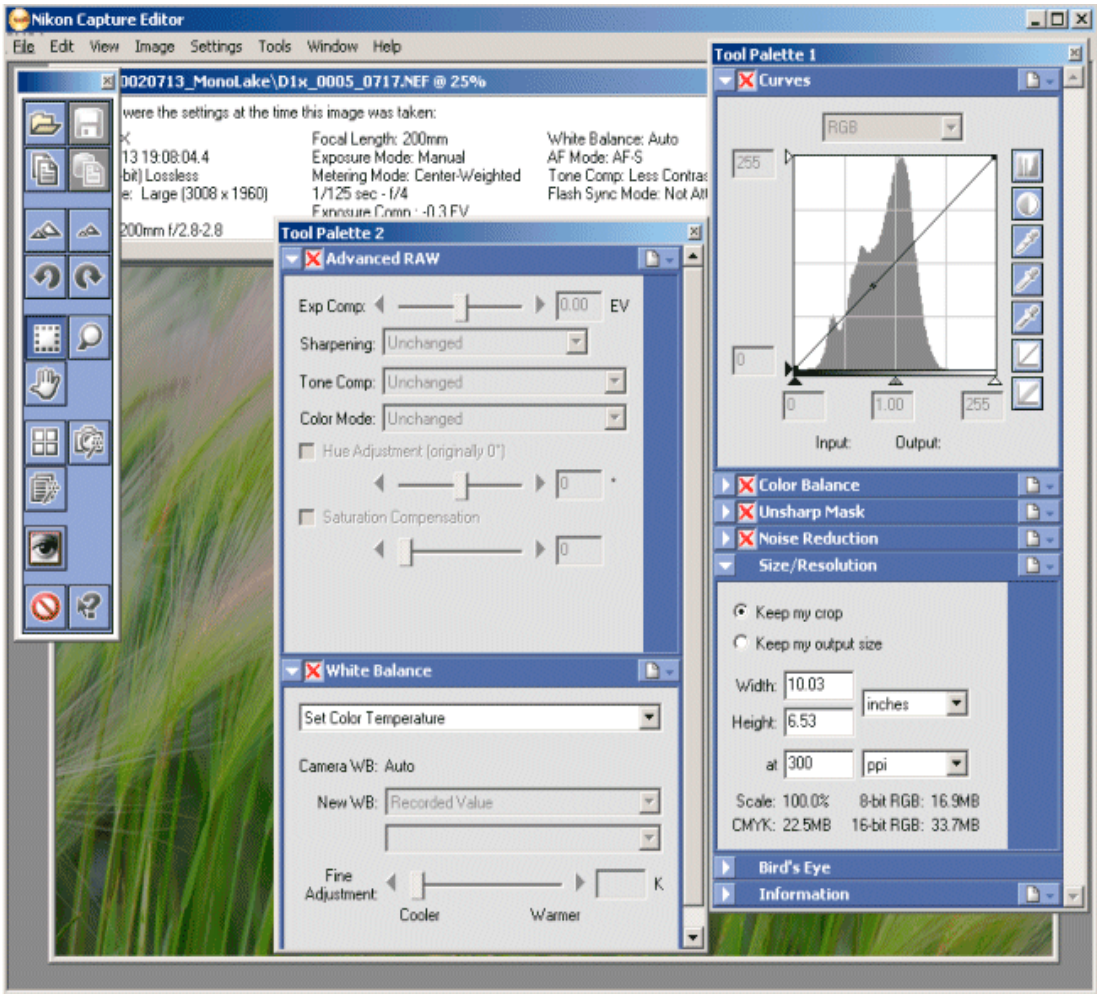


Figure 6-39: Nikon Capture

Although it must be purchased separately, if you are serious about conversion of Nikon RAW files, you need to buy this tool. If you use any of Nikon's excellent films scanners, you should seriously consider purchasing Nikon Capture. The kit includes both a Windows and a Mac OS version.

Stated again, this discussion is not intended to replace the manual. We describe only features used in our workflow.

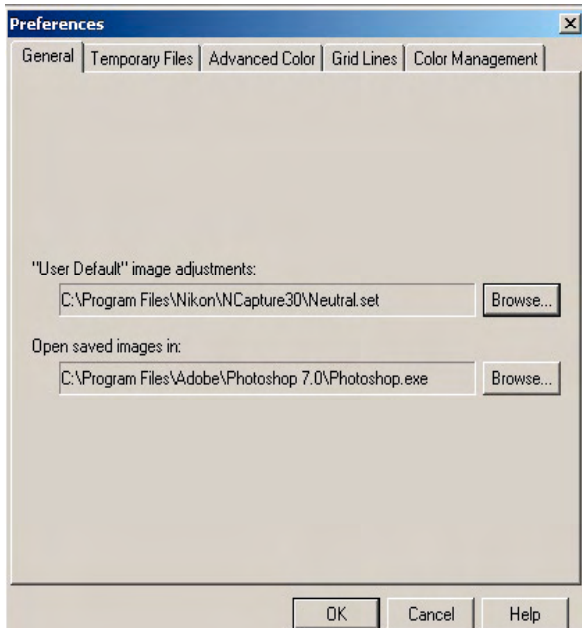
In our judgement, the quantity of windows and panels in a Nikon Capture screen can be a bit confusing.

When installing Nikon Capture after a Photoshop install, NC places an import filter into the Photoshop plug-in folder which prevents the Photoshop file browser from recognizing RAW files during Nikon RAW file import and redirects data to Nikon Capture instead. If you prefer to open NEF-files (Nikon RAW files) using primarily Camera Raw, you may remove this plug-in (called "Nikon NEF Plugin") from your Photoshop Plug-in folder (Import).

Setup

Preferences

You may launch converted files directly into Photoshop. That is why we suggest selecting the Photoshop application here. In fact, we do not use this feature in our own workflow.



◂ *Figure 6-40: Selecting the Photoshop directory*

Color management

This dialog box allows you to select your preferred working space and monitor profile.

We use Adobe RGB (1998) as our working space and select the system monitor profile (shown is the monitor profile for our Sony NV170 notebook).

You must restart Capture to make the monitor profile active.

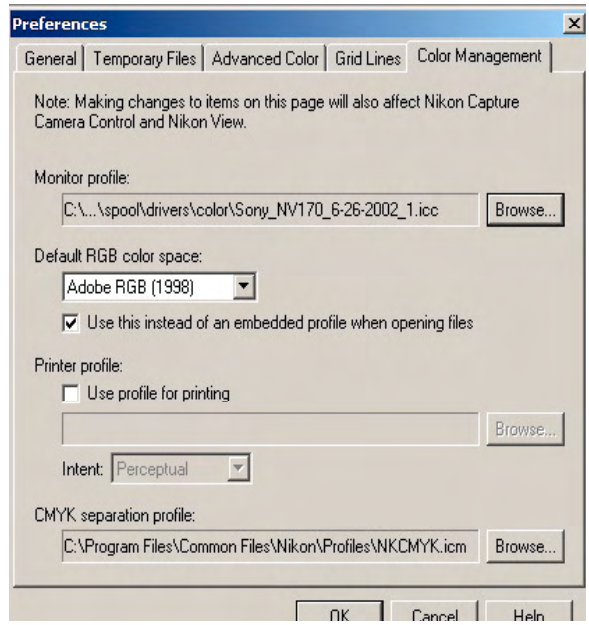


Figure 6-40: Color Management Settings

Main features

Let us assume you have opened a NEF photo in Capture 3 or 4.

Advanced RAW

Making correct settings in the "Advanced RAW" dialog box right is essential to your success.

- We will cover EV compensation later.
- Sharpening can be set to "low" or "normal". Normal sometimes introduces unwanted halos.
- Tone compensation is set to "normal" or, on a photo with stronger contrast, to "Less Contrast".

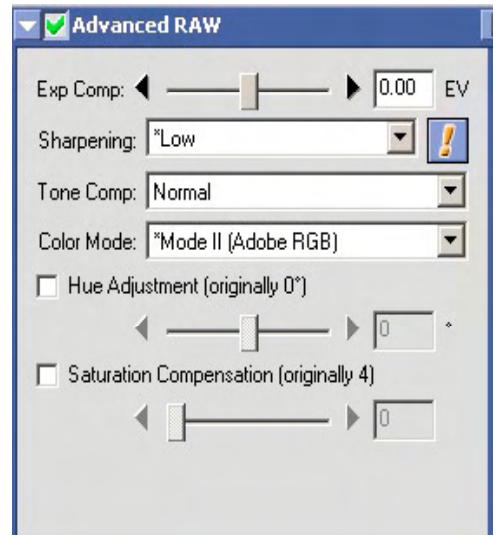


Figure 6-41: Advanced RAW Dialog

- For color mode, we use our working space "Mode II (Adobe RGB)".
- We rarely ever use the "Hue Adjustment" or "Saturation Compensation". If we need to correct these, we use Photoshop later.

Curves

The Capture 3 Curves tool is quite powerful and we prefer its interface to that of Curves in Photoshop. Capture lets us view the histogram. On the other hand, we attempt to minimize our work in the Capture converter and leave the rest to Photoshop.

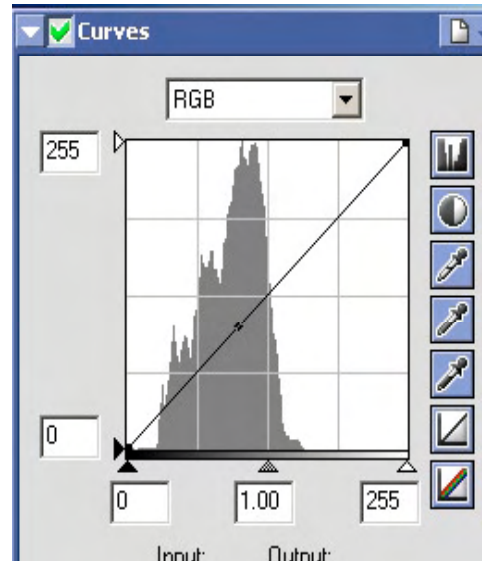


Figure 6-42: Capture Curves

Return to the EV compensation slider in the "Advanced RAW" dialog box. Starting with the histogram above, an EV of +1.0 would result in the histogram of figure 6-43.

As said before, you should limit modifications in Capture 4 and do the rest in Photoshop. In case of a light over-exposure, you must use a negative EV value for compensation. Play with the slider until you see no more spikes at the far right of the histogram. If necessary, set the Tone settings to "Less Contrast" to recover lost highlights.

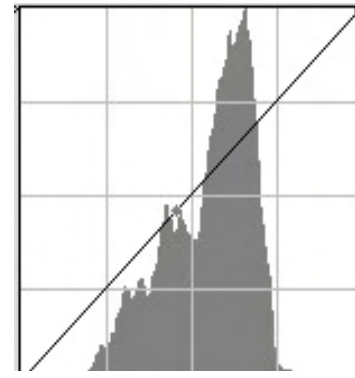


Figure 6-43: EV +1.0s

Size and Resolution

Most users will not need this dialog box. If we choose to print the photo larger than 17" wide, we upsize photos at an early stage (we upsize to a 12 Megapixel equivalent). This helps minimize the effects of degradation occurring later in the workflow when later upsizing of the photo is often done.

This setting permits printing up to 21" wide at 180 ppi without further resizing or increasing to 30" with no serious problems by utilizing Fred Miranda's SI actions. We were inspired to use this method by Paul

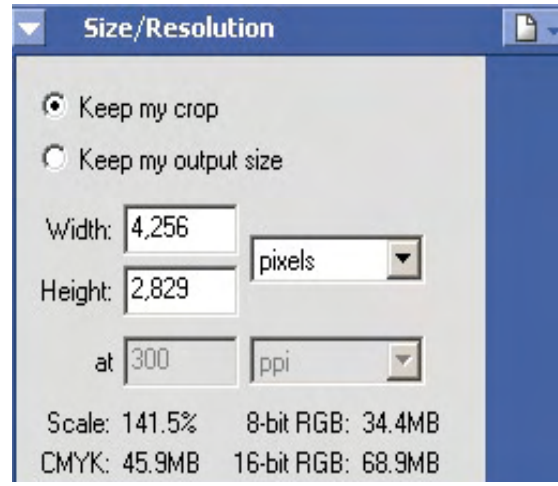


Figure 6-44: Upsizing In Capture

Tip: Experiment with this method as it may not be the right choice for you (and avoid it if you print smaller than 17" wide).

White Balance (WB)

Beyond EV, the other main task in Capture 4 is getting the white balance (WB) correct. There are two ways to correct WB.

Setting the color temperature

The settings in the image of figure 6-44 shows the way we use usually use this dialog box. Select the light source, such as "Daylight", then "Sunny", "Cloudy" or "Shade" and finally tune the color with the "Fine Adjustment" slider.

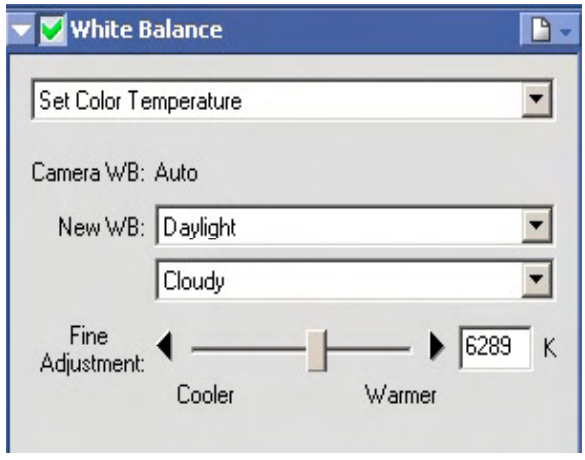


Figure 6-45: WB: Setting Color Temperature

In most photographs, we are more interested in the subjective color temperature than absolutely accurate color values. Most of our photos contain few well-defined gray areas to use with method 2.

Setting the Gray Point

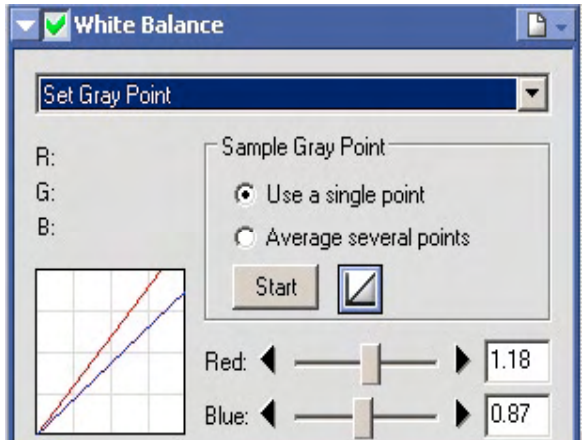


Figure 6-45: Setting WB Gray Point

Correcting the WB by clicking on a gray object in a photo (e. g. a gray card or ColorChecker) remains the method of choice if you need the best objective WB correction **and** you have a gray area inside your photo to use for a reference.

Save and load settings

Once you have established settings, save them.

- To save them: From the main menu bar, click Setting then select Image Adjustments and click Save.
- To recall them later: From the main menu bar click "Setting" then select Image Adjustments and click Load.

Tip: Save the settings you use most often and recall them for each photo you process.

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Chapter 7

Perfecting Images

Camera: Sigma SD10

7.1 Do you really need to bother with this?

For many casual images you may never have the desire to look into all the minor shortcomings of digital images. But the camera and lenses (even the more expensive ones) are far from being perfect. There are several different defects, you should watch for and then decide if you can life with it or that you should work on.

Here are some of the more important defects that we will cover in this chapter:

- Image blur (lack of sharpness) which can have many sources
  - Lens blur
  - Blur introduced by the camera's AA filter
  - Motion blurs. There are tools that deal with this to some extent. But you better use fast shutter speeds or a tripod.
  - Out of focus blur. This is hard to deal with. You better use a higher f-stop to gain more depth of field.
- Noise. There are three types of noise:
  - Color aliasing
  - Luminance noise
  - Moiré
- Chromatic aberrations
- Lens distortions
- Vignetting
- Rotation (more related to wrong camera setup)
- Perspective corrections
- Removing dust spots

You should not get that worried about all these problems and tackle them only if you feel they distract from your images.

Why did nobody bother that much about this with film? First, in the high-end people did bother but had a very hard time to correct it. Second, with digital we have now many good methods to minimize all these flaws.

Actually Photoshop CS2 adds three new tools to help reducing all of the above defects:

- Smarter Sharpen
- Reduce Noise
- Lens Correction
  (corrects many different types of defects created by lenses)

7.2 The art of sharpening

All digital photos require some sharpening. Especially since the AA filters (Anti-Aliasing-filters) in most digital SLRs blur the image a bit to decrease color aliasing (see description at page 1-9).

Sharpening is one of the most difficult and subjective topics in digital photography but good tools are available and continue to improve.

The sharpening process has a built-in contradiction: While giving the impression of sharpness improvement, the viewer should be aware that some smaller details might get lost during this process. That is why the targeted viewing distance is very important.

Sharpening may be done in (at least) three stages of your workflow:

- In the camera
  (not if you shoot RAW files, and we even do not recommend it, if you shoot JPEG or TIFF and do some optimizations in Photoshop later).
- In the RAW converter.
  We rarely use this and but most of the time just use a sharpening of the preview image without actually sharpen the image. However you might slightly sharpen the image in the RAW converter and do some more sharpening in Photoshop afterwards. RawShooter seems to do a better job with sharpening than other RAW converters do. So with RawSHooter you may use a bit more of sharpening.
- In Photoshop.
  This is our preferred method as you have a very high level of control and may even restrict sharpening to certain areas of the image. There are quite a number of good sharpening tools as plug-ins for Photoshop.
  Even in Photoshop a three step sharpening may be the best way:
  - A slight overall sharpening to improve the image
  - A selective sharpening restricted to those areas of your image, that improve with further sharpening and that should be in the focus of the viewer. Bruce Fraser calls this a *creative sharpening*.

– A final sharpening as one of the very last steps before outputting. This sharpening should be done when the picture is scaled for output and it should be adapted to the output method. Digital slide show need almost not sharpening, while printing using an inkjet printer or an offset printer need much more sharpening, due to its printing process using dithering. Output on a lightjet printer or a dye sublimation printer requires less sharpening. Part of this final sharpening may even be done by the RIP (*Raster Image Processor*) if you use one and the RIP is supporting this (e. g. Qimage , see [33]) supports it).

USM (Unsharp Mask)

The classic tool for sharpening in Photoshop is USM (*Unsharp Mask*).

It is also important to be aware that it is difficult to judge sharpening on the screen. A photo that looks hopelessly over-sharpened on the screen might be exactly right for some inkjet printers.

Sharpening artefacts should be limited to a minimum:

- Halos (white or black borders at edges)
- Noise will get sharpened as well, making it more pronounced.

There are a lot of sharpening tools out there and it is up to you to figure out your favorite methods.

How Photoshop “Unsharp Mask” works

The most used tool for sharpening is probably straight USM (Unsharp Mask) in Photoshop and nearly all techniques are a variation of it. To get an understanding of the sharpening issues you need to better understand how Photoshop USM works and its inherent limits.

Figure 7-1: Sample Picture (not sharpened)

We open the Filter ▸ Sharpen ▸ Unsharp Mask Dialog:

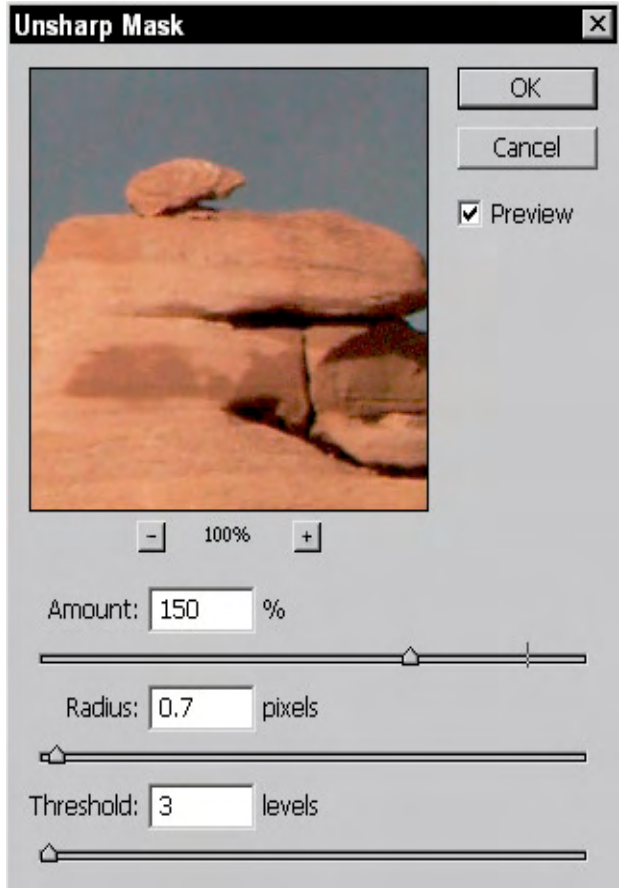


Figure 7-2: Unsharp Mask Dialog

In (almost) all cases you should check the Preview button. Three factors control USM:

- Amount
- Radius
- Threshold

Amount ▸ defines the strength of the new improved contrast at edges. The optimal amount depends very much on your image. Start with a value of 50–100 % and carefully watch the effect with your image that should be set to an enlargement level of 100 % (or even a bit more).

Radius ▸ determines how many pixels are involved to build the new edges with higher contrast. Often 0,5–1,0 are good values, though the best value is very dependent on the resolution of your image. The higher the resolution, the higher Threshold may be. An inadequate high value will result in a high contrast and artefacts.

Threshold ▸ defines "how different the sharpened pixels must be from the surrounding area before they are considered edge pixels and sharpened by the filter" (see Photoshop Help) and is needed to avoid sharpening noise too much.

Good values are very much dependent on the resolution of the image (ppi – *Point per Inch*). The higher the resolution, the higher values of *Amount* and *Radius* may be selected.

◂ *Figure 7-3: Sharpened Image*

What is the dilemma? You can either sharpen too little or too strong so that the image gets severely damaged by showing light or dark halos

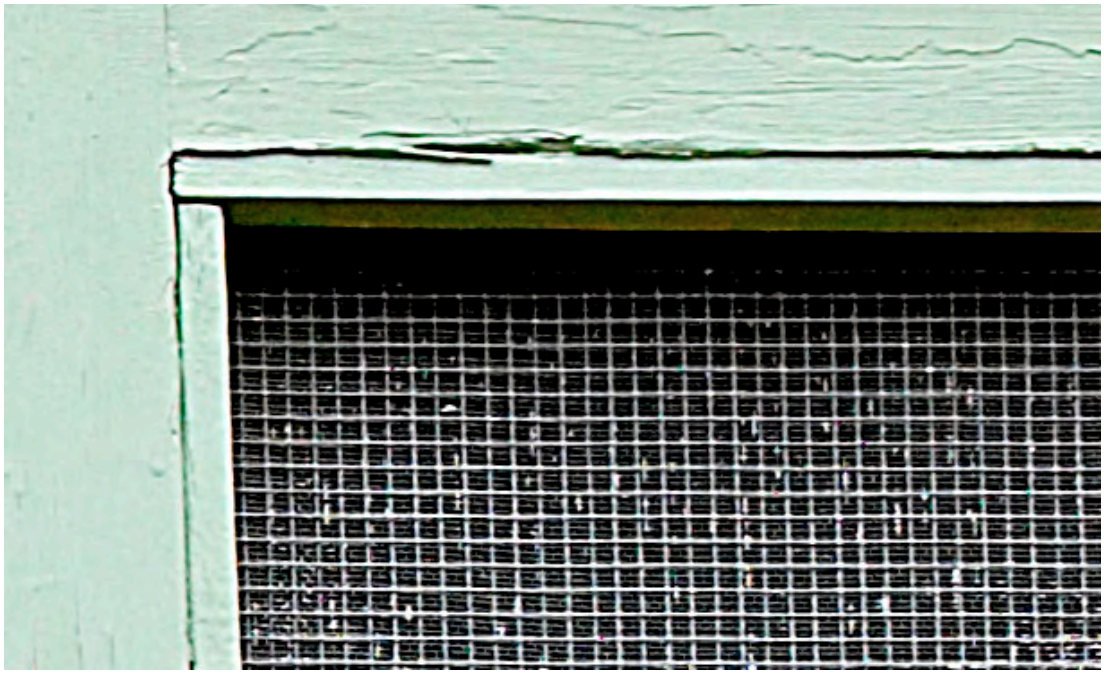


Figure 7-4: Image shows strong halos

We would caution you to stay on the side of low sharpening. If you images only impress by being sharp then try to work on the content.

> Here is short story. We looked at some Cibachrome prints in one of Carmel's top photo galleries. None of the prints in that show was critically sharp. But they all were beautiful. Remember sharpness is only a tool to improve the content.

Since the sharpening effect is also a function of the resolution and the printing technology, finding optimal settings can be a lengthy process and needs a lot of experience. There is also a principle limitation to USM: all settings are global for any given image. But you might want to sharpen the skin (smoother) different from the hair (much more crisp) for a portrait. Also avoiding amplifying the noise using plain USM can be tricky.

That is why there are a huge number of different sharpening techniques published (most often based on some edge masking) and many Photoshop plug-ins that try to make sharpening easier.

Note: There is no simple "one size fits all" solution to sharpening.

The two step approach

The two-step approach is a simple way to get started in sharpening

- Low sharpening in the RAW converter
- Final sharpening in Photoshop

We don't really do any sharpening in the RAW converter and use later only EasyS Sharpening Toolkit in Photoshop. That does not mean that the RAW converter sharpening is that bad but we find that good sharpening tools in PS offer more control.

Once you have a grip on sharpening, have a look into the many sharpening tools we show at Digital Outback Photo ([8]) and pick the technique that fits your workflow and image best.

Photoshop CS2: Smarter Sharpen

In Photoshop CS2 we finally get an improved sharpening over plain USM.

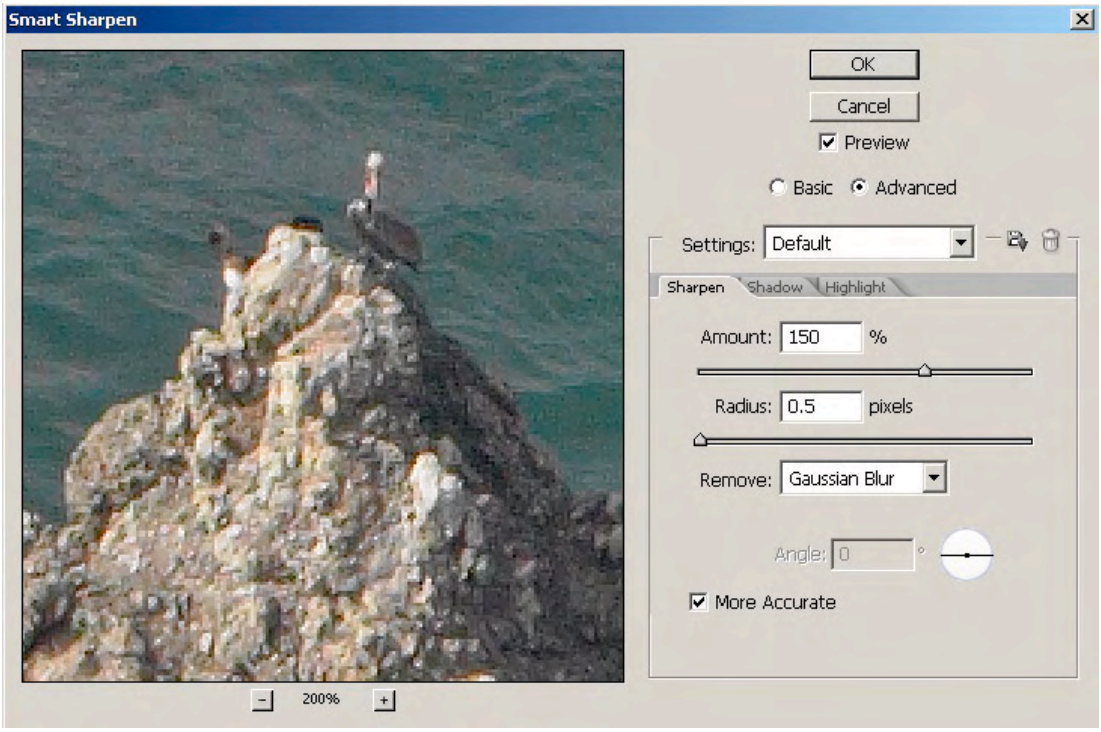


Figure 7-5: Photoshop CS2 Smarter Sharpen

In advanced mode you can also tune the sharpening for the shadows and highlights. In general you don't want to sharpen the extreme shadows (Noise) and the also not the bright highlights.

Other Sharpening Tools

In our daily work we use several advanced sharpening tools.

There are a lot of sharpening tools out there and it is up to you to figure out your favorite. Here are a few of our favorites.

- Our own EasyS Sharpening Toolkit (, ; see [46])
- Focus Magic (, see [31])
- Focus Fixer (, ; see [32])

7.3 Noise reduction

Small sensors and larger sensors at higher ISO settings can show different kinds of noise. This is mainly visible in the shadow parts as here the signal to noise ratio gets very low. For more information on noise in digital images read our paper at [8]. The whole industry is working on sensors and software that allows lower and lower noise levels.

Actually removing noise is easy. But removing noise and keeping finest details and without muting color is the real challenge.

There are several types of noise:

- Fine and coarse (hard to remove)
- Luminance noise (detail noise)
- Color noise (means false color pixels in homogeneous colors)

Figure 7-6: Shows Luminance and color noise

Fortunately we have now quite a few good programs (and all the good also work as Photoshop plug-ins) that can do a great job reducing noise.

But first check whether your noise is really a problem in your prints. Only reduce the noise so far that you keep detail and avoid some sort of plastic look in your images.

After the use of some noise removal filter, we get the image of figure 7-7:

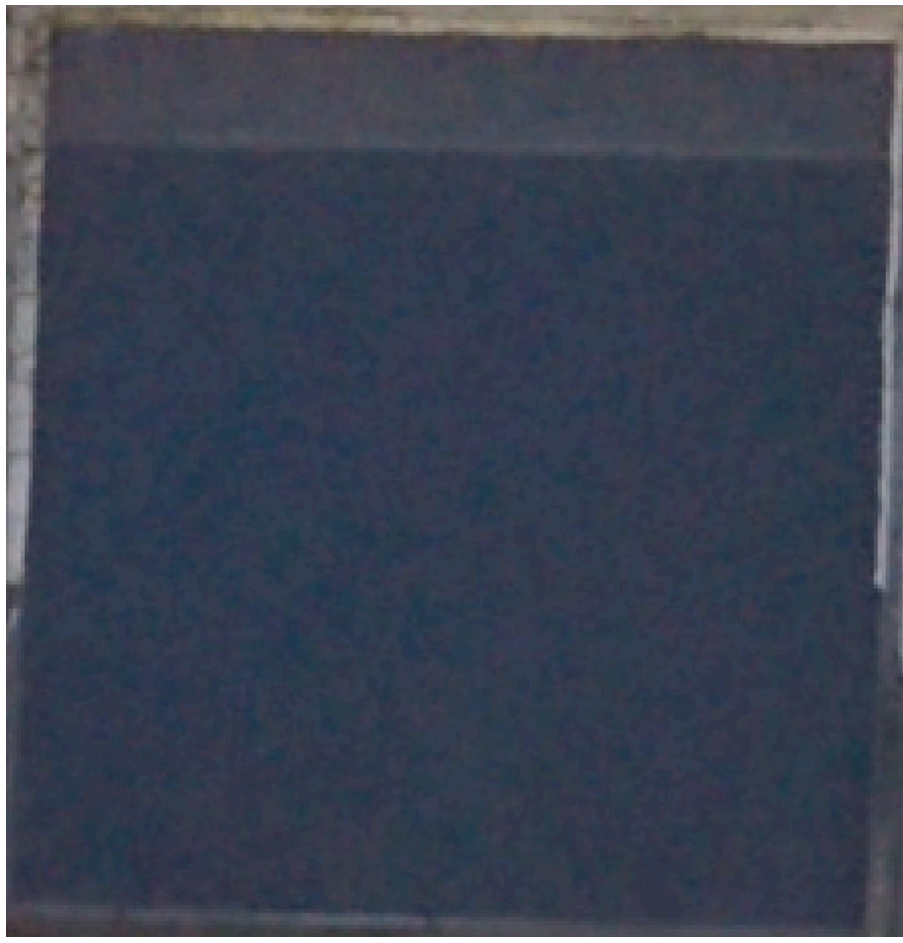


Figure 7-7: After noise removal

Photoshop CS2: Reduce Noise

Finally Photoshop CS2 also got a very usable noise filter Reduce Noise:

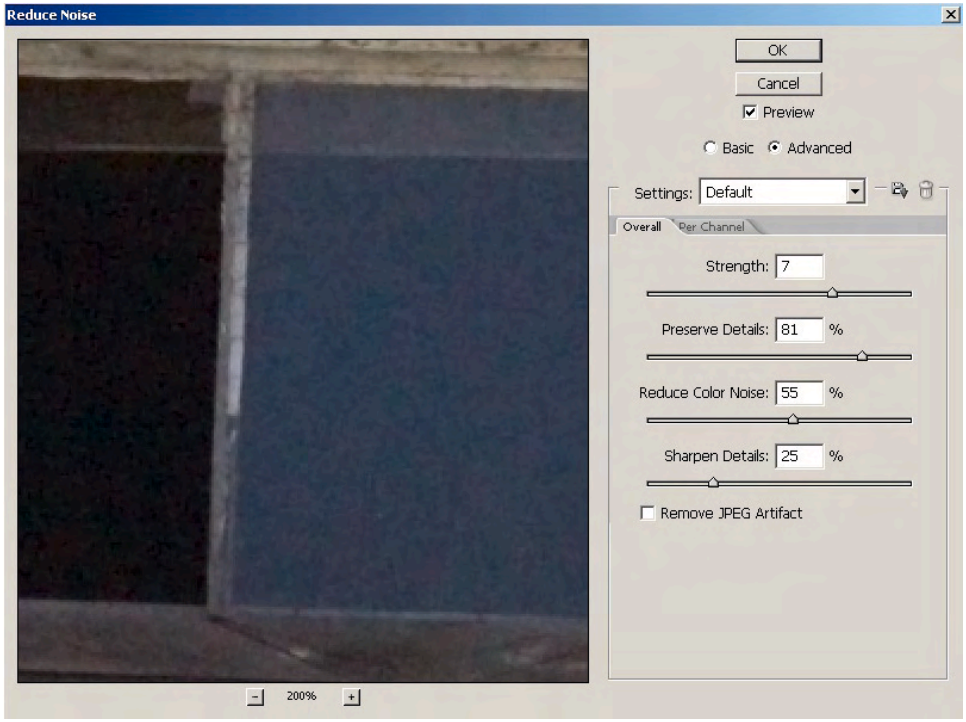


Figure 7-8: PS CS2 Reduce Noise

As noise may be stronger in some channels – usually the blue channel shows more noise – it may be well worth to use the Per Channel tab and start noise removal with the blue channel. This may preserve more details in your red and green channel.

Noise is in the shadows

Because noise is primarily present in the shadows it can be very useful to perform the noise removal in a new layer and then use a Layer Mask so that the noise removal is only active in the shadows. We use the masks from our own Tonality Tuning Toolkit (see [7]).

Other Useful noise removal filters

We find the following noise filters very useful:

- NoiseNinja (, ; see [12])

- NeatImage (, ; see [27]). There is a Standard and a Pro edition. This is an excellent tool.
- Noiseware (, ; see [28]). There is a Standard and a Pro edition)
- Helicon Filter Pro (; see [29]) This is superb freeware tool)

If you work with 16-bit images, which we recommend to do, you usually have to buy the Pro versions of the tools.

7.4 Reduce chromatic aberration (CA) and purple fringing

Chromatic aberration (CA for short) is actually a fault that nearly all lenses show. Whether it is also shows in the final image is up to the quality of the lenses used. Most of the time chromatic aberrations show as purple/green fringing and it gets stronger the more you get into the corners. The reason is that the lenses have a different focal plane for the different colors. Especially consumer class digital cameras show more CA than high end digital cameras with top lenses.

There is also purple fringing that may look the same but is the result of leaks in the imaging sensor (e. g. The Sony F828 shows both strong chromatic aberrations and purple fringing).

Heal chromatic aberration (CA)

Lower quality lenses but also some prime lenses used with full frame sensors show mostly in the corners so called *chromatic aberration* (CA). It shows as magenta and green borders at opposite sides of high contrast edges.

Figure 7-9: Sample Chromatic Aberration (left) and the fixed result in Camera Raw 2/3 (right)

If you don't use Adobe Camera Raw and did not upgrade to Photoshop CS2 yet, then you may use the Photoshop plug-in Debarrelizer (see [30]) It corrects lens distortions and chromatic aberrations):

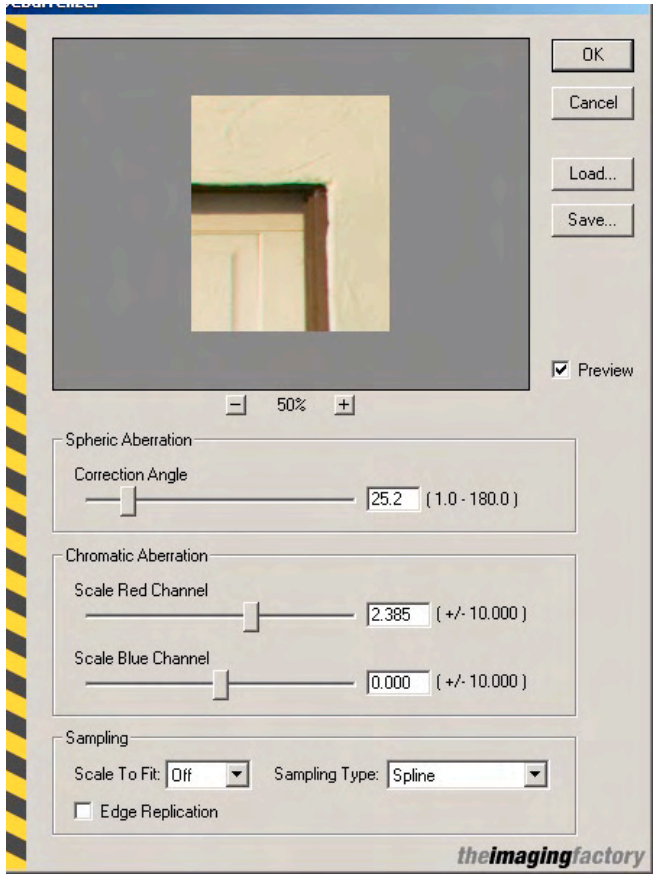


Figure 7-10: CA removal in Debarrelizer

Photoshop CS2: Lens Correction

New in Photoshop CS2 you can also fix chromatic aberration outside of Camera Raw using the Lens Correction filter:

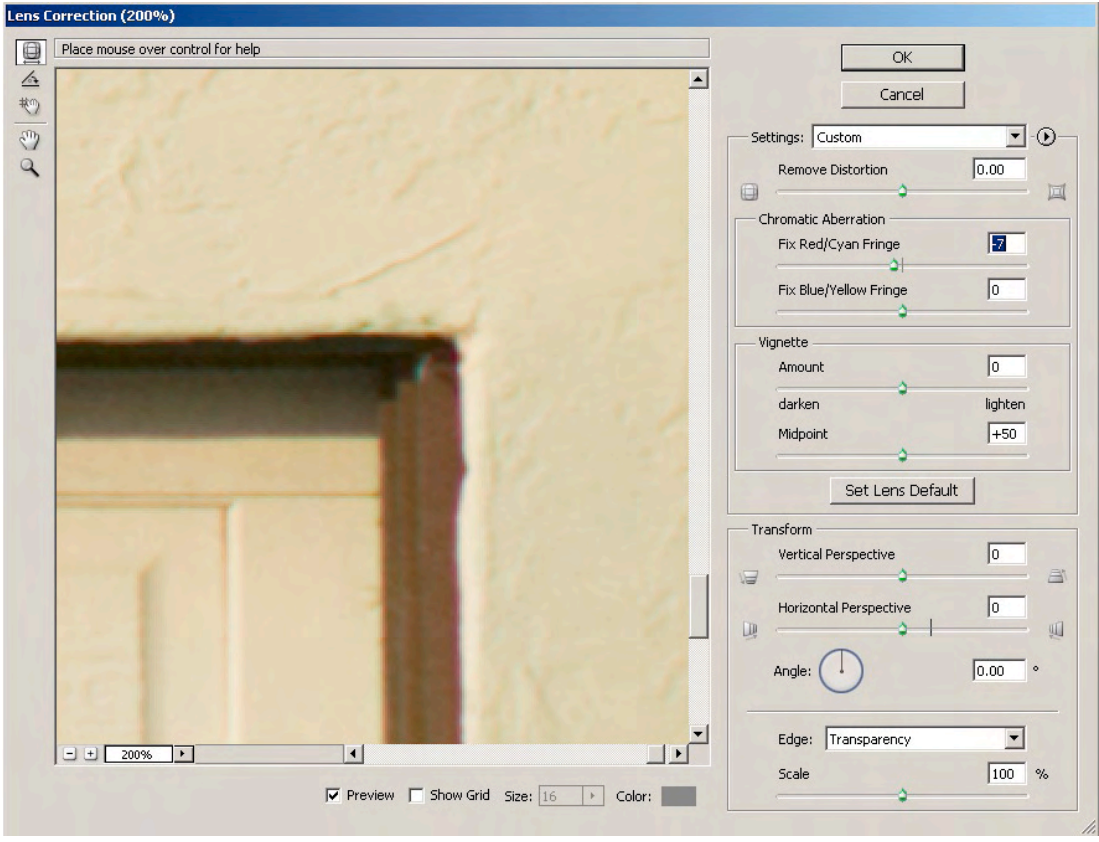


Figure 7-11: "Lens Correction" filter of Photoshop CS2

Heal purple fringing

Here is a real example we got from a Sony F828. We show how to make useful images from such files.

First get a free version of Panorama-Tools. You have to search the web where to find it, as we have no right to distribute this free software. A good start will be [40]. There you find a user friendly front end to Panorama-Tools as well.

The following is working on the original file (that was not sharpened)

Fig. 7-12: Original with strong CA

1 Because we are using layers we create a new layer with the result of all current flattened layers in it.

2 Using Panorama tools to remove some CA

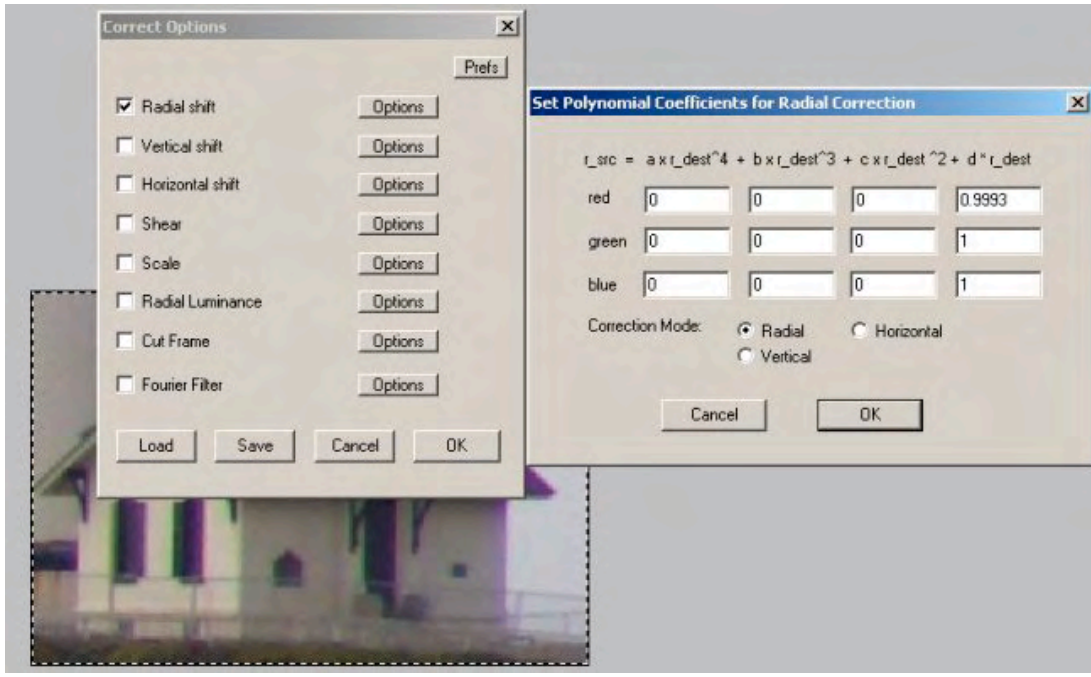


Figure 7-13: Correct radial shift in Panorama Tools

These parameters may vary with the focal length.

Fig. 7-14: After Panorama Tools

This step removes some purple and even more the green CA fringing.

3 Reduce purple

Use Photoshop Hue/Saturation tool to reduce the purple:

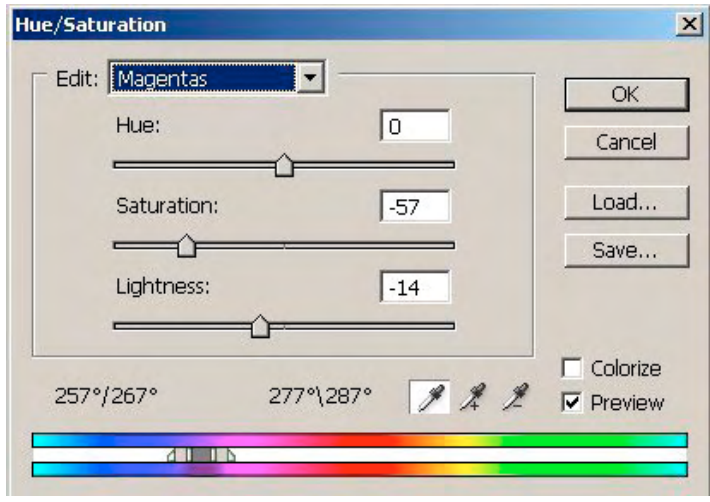


Fig. 7-15: Selectively reduce a narrow color range of purple

It will leave desaturated areas in the picture but not as bad as purple (see figure 7-16).

Fig. 7-16: Result after applying Hue/ Saturation

4 (Optional): You may additionally (or alternatively) reduce magenta using Selective Color Options:

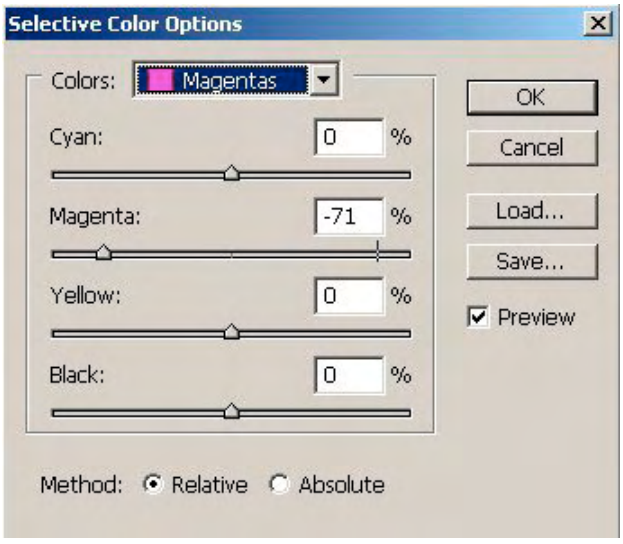


Figure 7-17: Purple finging may also be reduced using the "Seletcive Color Options"

7.5 Distortion

You will be surprised how much distortion even good lenses may show. But the good news is that you hardly will see it with images that have no straight horizontal or vertical lines. However once you photograph architecture it can be quite an annoyance.

There are two kinds of correction tools:

- Visual corrections based on barrel or pincushion distortions
- Profile based correction based on measured profiles for camera/lens combinations

Whenever possible use a tool that is profile based as the correction will be more correct and automatic. But also the other tools will help you getting a pleasing result.

Profile based corrections

Clearly our favorite tool is the free PTLens plug-in (see [25]). Unfortunately it is only available for the PC right now. For Mac OS however you may buy LensFix ([26]) at a very reasonable price. It is based on the same technology.

Here is an example:

Figure 7-18: Strong barrel distortion

PTLens can correct this automatically knowing the right camera/ lens combination (even tries to get as much info from the image EXIF as possible).

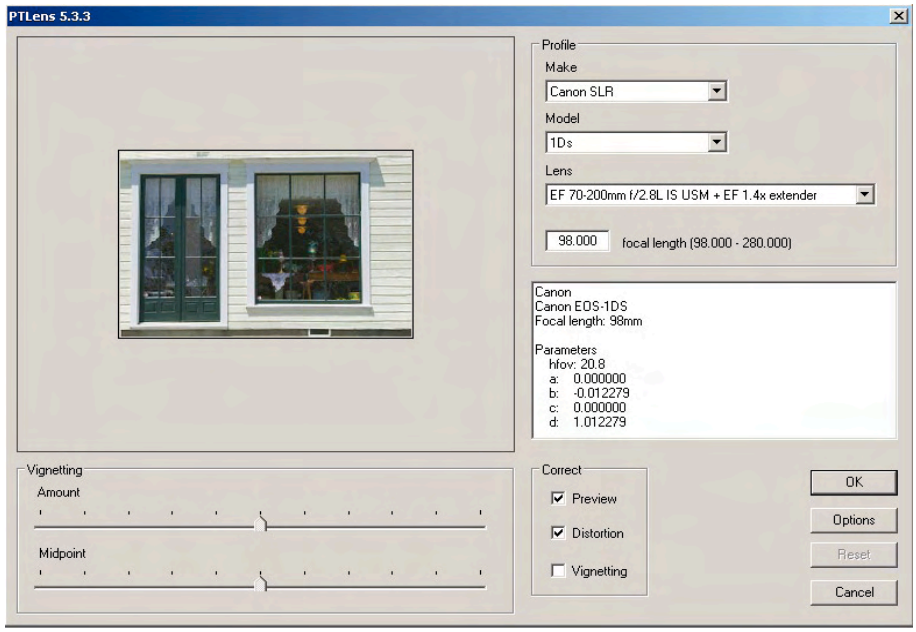


Figure 7-19: PTLens User Interface

The resulting image looks much better now:

Figure 7-20: Corrected Image

In some case PTLens can even be used for correcting distortions created by fisheye lenses:

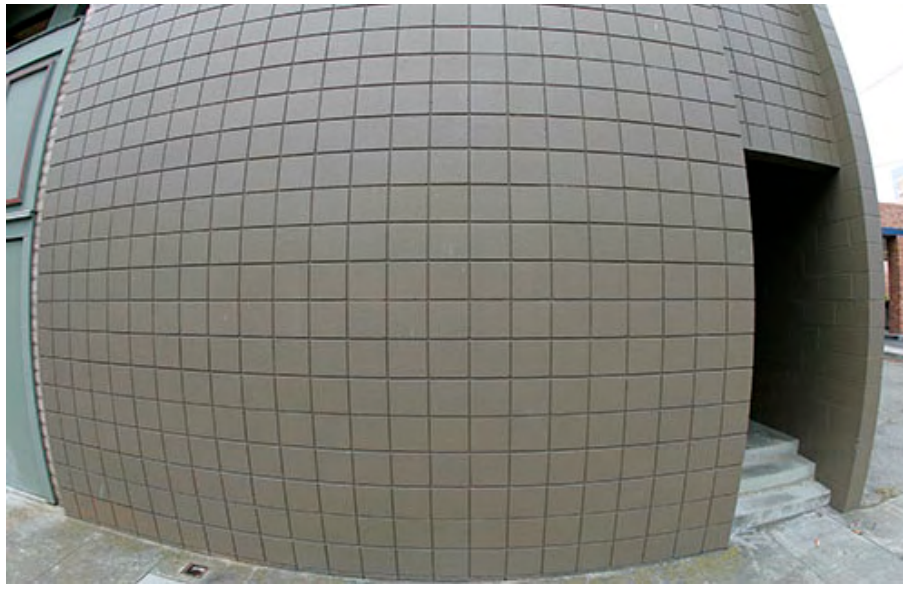


Figure 7-21: Canon 15 mm fisheye lens

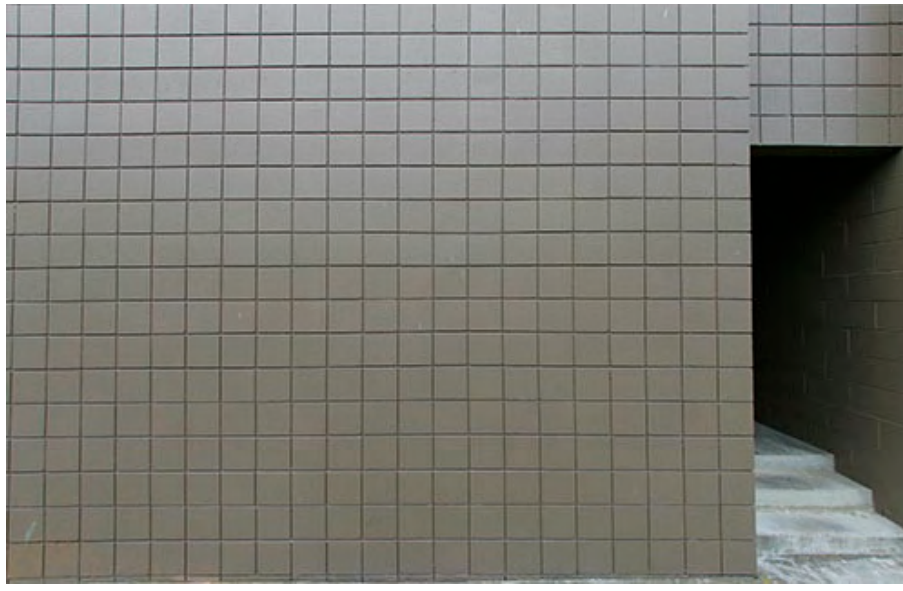


Figure 7-22: Corrected distortion using PTLens

Photoshop CS2: Lens Correction

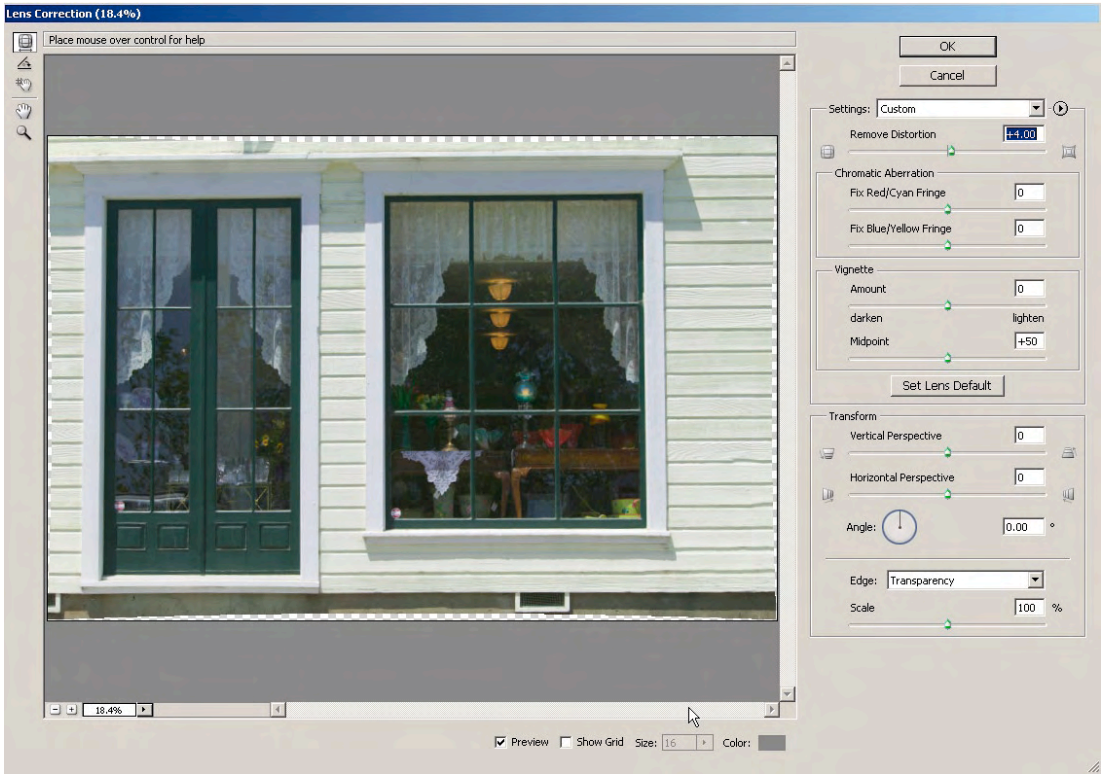


Figure 7-23: Corrected image using the Photoshop CS2 "Lens Correction" filter

The correction in the Photoshop CS2 Lens Correction filter may be not as perfect as in PTLens but in most cases it will perfectly do the job. Remember, in the old days you did not do any correction at all.

7.6 Vignetting

We encounter this problem rarely. But wide-angle lenses at open aperture or some flash photos may suffer from Vignetting like the picture of page 7-23 (this is only a demo, the real image had only minor Vignetting that would not show that well in the book):

◂ *Fig. 7-24: Severe Vignetting*

Vignetting can be fixed in ACR or in the CS2 Lens Correction tool:

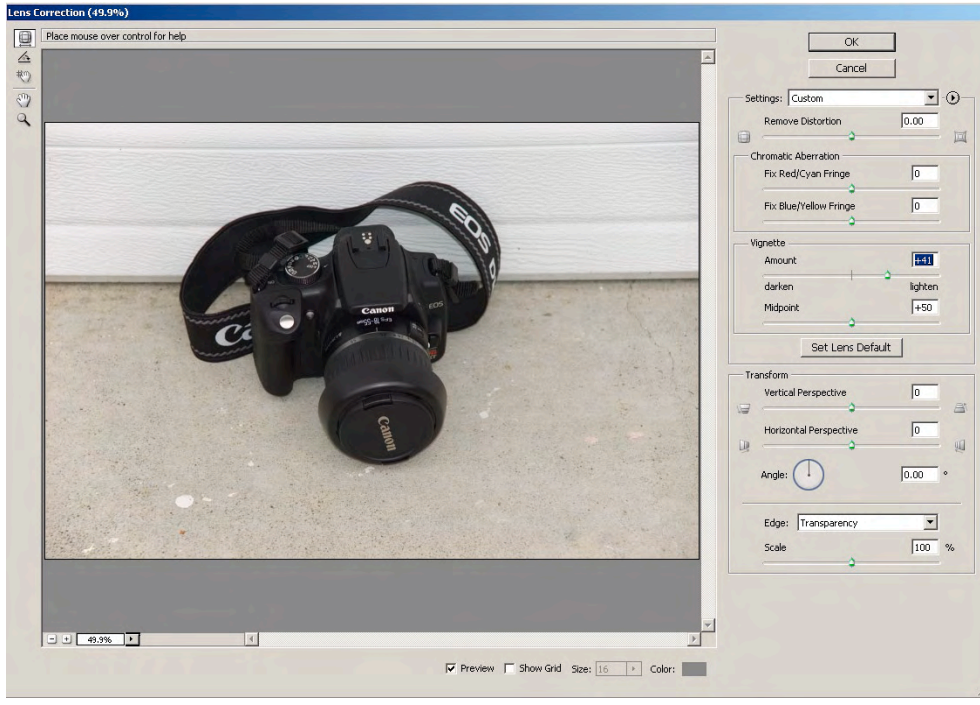


Figure 7-25: Quick fix in Lens Correction

Midpoint does not define the midpoint of vignetting, but defines how far from the middle of your image vignetting-correction should start. In some cases this may not be enough, as some lenses show an unsymmetrical vignetting behavior.

As always we advise not to over correct the images. These are still photos and should show that they come from the real world.

Some enforced vignetting however may also be used as a creative touch to your image. Slightly darkening the outer border of your photo may lead your viewer to focus to the middle of the frame where you usually want the focus to be. For this, use a negative value for Amount. However as this effect will create a circular darkening, in most cases we would prefer to use a darker frame produced in Photoshop.

7.7 Correcting tilt and perspective corrections

Rotation (correcting tilt)

Some RAW converters help to correct tilt directly (e.g. ACR 3.x and Capture One). For all the others you can easily use Photoshop and especially the CS2 Lens correction filter. If you choose to work with an 8-bit image in Photoshop, doing a correction in the RAW converter has some advantages, due to the 16-bit mode used there. If you prefer to correct it in Photoshop, we would recommend staying in 16-bit mode until the tilt is correct and other corrections are done as well and only convert to 8-bit mode afterwards (Image ▸ Mode ▸ 8 Bits/Channel).

If you have to do some image alignment, you should do the cropping after aligning the image.

Perspective corrections

Figure 7-26 shows a classic image that shows a perspective distortion:

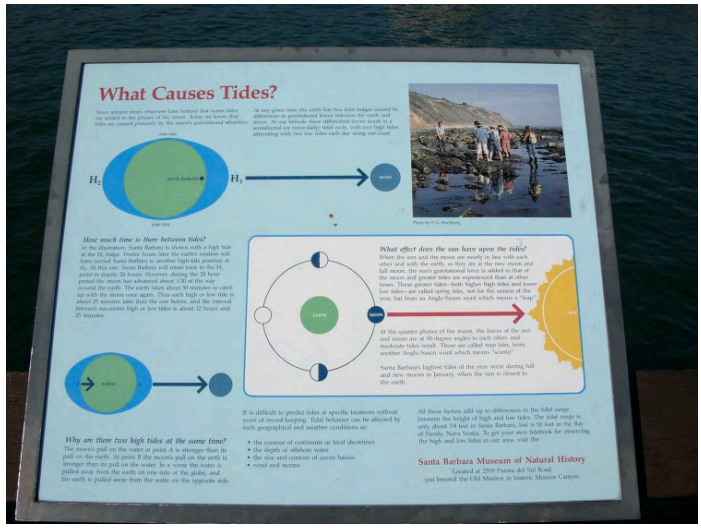


Figure 7-26: Perspective distortion

Besides a strong perspective distortion it also shows minor lens barrel distortions. Both can be corrected in one step with the new PS CS2 Lens Correction filter (Filter ▸ Distort ▸ Lens Correction).

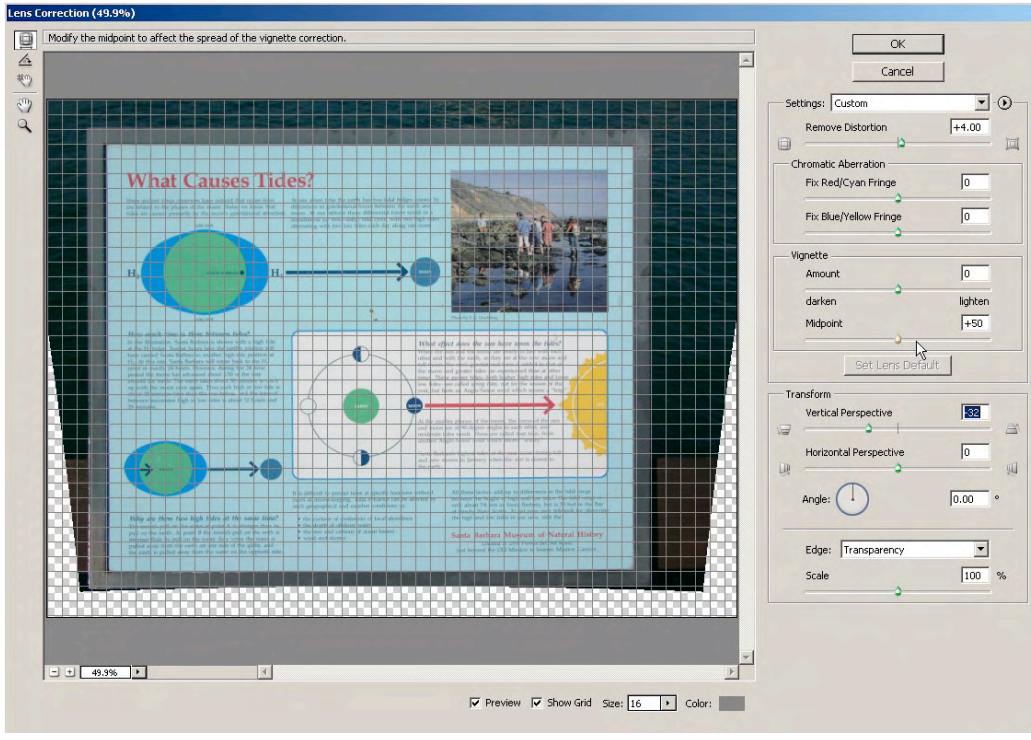


Figure 7-27: Lens Correction filter

For this correction you need the grid enabled in the filter. Here (Figure 7-28) is the final image after a crop:

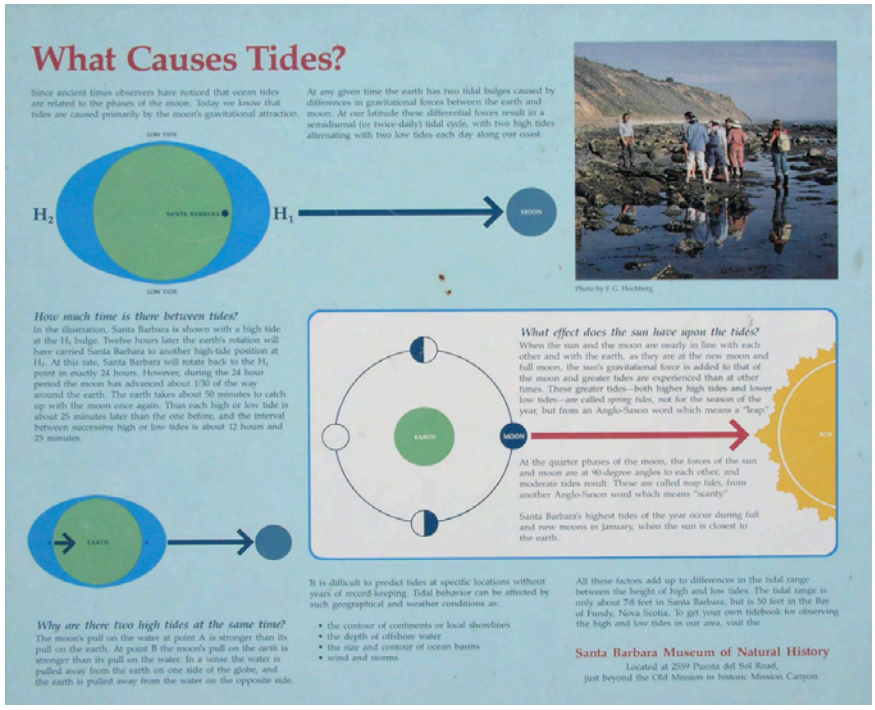

What Causes Tides?
Since ancient times observers have noticed that ocean tides are related to the phases of the moon. Today we know that tides are caused primarily by the moon's gravitational attraction.
At any given time the earth has two tidal bulges caused by differences in gravitational forces between the earth and moon. At our latitude these differential forces result in a semidiurnal (or twice-daily) tidal cycle, with two high tides alternating with two low tides each day along our coast.
LOW TIDE
H_2
SANTA BARBARA
H_1
MOON
LOW TIDE
Photo by F. G. Hochberg
How much time is there between tides?
In the illustration, Santa Barbara is shown with a high tide at the H_1 bulge. Twelve hours later the earth's rotation will have carried Santa Barbara to another high-tide position at H_2. At this rate, Santa Barbara will rotate back to the H_1 point in exactly 24 hours. However, during the 24 hour period the moon has advanced about 1/30 of the way around the earth. The earth takes about 50 minutes to catch up with the moon once again. Thus each high or low tide is about 25 minutes later than the one before, and the interval between successive high or low tides is about 12 hours and 25 minutes.
EARTH
MOON
What effect does the sun have upon the tides?
When the sun and the moon are nearly in line with each other and with the earth, as they are at the new moon and full moon, the sun's gravitational force is added to that of the moon and greater tides are experienced than at other times. These greater tides—both higher high tides and lower low tides—are called spring tides, not for the season of the year, but from an Anglo-Saxon word which means a "leap."
At the quarter phases of the moon, the forces of the sun and moon are at 90-degree angles to each other, and moderate tides result. These are called neap tides, from another Anglo-Saxon word which means "scanty."
Santa Barbara's highest tides of the year occur during full and new moons in January, when the sun is closest to the earth.
Why are there two high tides at the same time?
The moon's pull on the water at point A is stronger than its pull on the earth. At point B the moon's pull on the earth is stronger than its pull on the water. In a sense the water is pulled away from the earth on one side of the globe, and the earth is pulled away from the water on the opposite side.
It is difficult to predict tides at specific locations without years of record-keeping. Tidal behavior can be affected by such geographical and weather conditions as:
• the contour of continents or local shorelines
• the depth of offshore water
• the size and contour of ocean basins
• wind and storms
All these factors add up to differences in the tidal range between the height of high and low tides. The tidal range is only about 7.8 feet in Santa Barbara, but is 50 feet in the Bay of Fundy, Nova Scotia. To get your own tidebook for observing the high and low tides in our area, visit the
Santa Barbara Museum of Natural History
Located at 2559 Puesta del Sol Road, just beyond the Old Mission in historic Mission Canyon.

Figure 7-28: Final corrected picture

7.8 Removing dust spots

Sometimes the CCD or CMOS sensors collect dust. These spots are easy to see in brighter parts of the image (e.g. sky). Here you can use the Photoshop clone tool to copy over the spot with a similar area of the image.

Photoshop 7.0 introduced a very sophisticated clone tool: the "Healing Brush" . The healing brush melds the source and target areas together and often produces a more pleasing result than the clone tool. Here is a sample dust spot:

Figure 7-29: Sensor Dust Spot

Select the Healing Brush tool in the PS tools palette. Then press the Alt key and the source cursor shows up (can be hard to spot if the color of the cursor is close to the background color). You then click in an area where you want to sample patterns to replace the target (here the dust spot).

Figure 7-30: Selecting the source for the Healing Brush

Then you create a brush that is slightly bigger than the dust spot, position it over the spot, and click with the mouse button.

Figure 7-31: Apply Healing Brush

The corrected image

This is actually not an easy example as the dust spot sits on top of a cloud pattern and could be improved to better reflect the original pattern.

We rarely use the clone tool anymore to remove unwanted parts from a photo.

Comment by Phil Lindsay: "Yes, it's true that the healing tool is great but there are still instances in which the rubber stamp may work better; especially if the two regions have grossly different colors."

Patch tool

The Patch Tool uses the same algorithms as the Healing brush, and can be used to remove, or move, areas in your picture.

We use it here to remove the same dust spot. This time we use the Patch Tool . The first step in using the Patch Tool is to select the area you want to remove (works like a lasso):

Figure 7-32: Patch Tool Selection

Then you drag the selected area to a place with a pattern that should replace the source:

Figure 7-33: Move selection to a replacement source

The result is close to our first attempt:

Figure 7-34: Result after Patch Tool use

Sometimes you need to use the Healing Brush for a final touchup of the patched area.

Using Selection with the Healing Brush

Here is a spot on the CCD (actually residue from canned air, ouch):

Figure 7-35: Major spot

Here the use of the healing brush is tough.

- Work at about 400 % magnification
- Select the area with a rectangular marquee that you want to protect from the healing brush and invert the selection

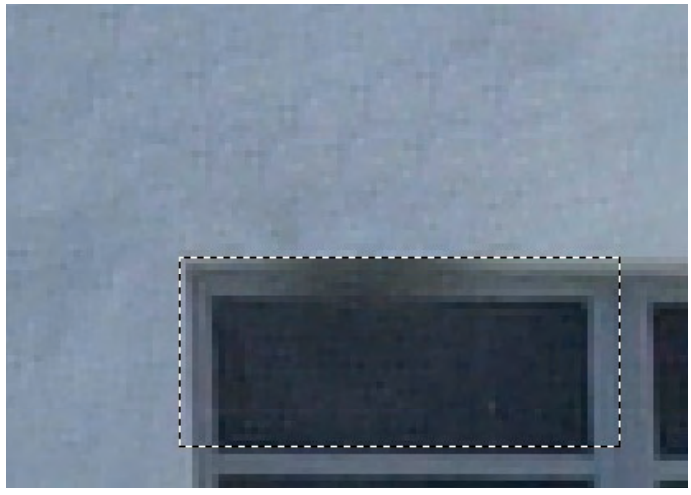


Figure 7-36: Protect window

- Now the healing brush is restricted to the selection and would not interfere with the areas that are not selected (in this example the window).

After some more work we get a final result that looks like figure :

◂ *Figure 7-37: "Healed" image*

This is not really perfect work but would not be seen in smaller to midsize prints. This is a good example how the healing brush can save your day.

Chapter 8

Batch Processing techniques for RAW files

Camera: Canon 1DS

When shooting digitally, the number of pictures taken and processed will quite likely surpass numbers done with your analog camera by as much a factor as 2 to 5. For this reason alone, processing photographs individually is inefficient and usually not viable. In most cases, you will want to batch process most images.
All RAW converters described in this book allow you to do just that – some in easier and more efficient ways than with others.

8.1 Basic batch processing pattern

The basic mode used for batch processing is quite similar with all converters described:

- Inspect and sort your files into those you wish to keep and those you want to delete. This usually reduces the number of files by a factor of 1.5 to 2.
- Sort your files, grouping together all files having similar lighting conditions or possibly those with contrast and color problems grouped together. To do this, tag them, using the browser of your choice. You may also choose to group them for different conversion or output settings.
- Next, process the either the first (or most typical) picture of a group with your RAW converter, taking all necessary care to achieve optimal results.
  If you do not have time or patience for that, you may use the RAW converter's default settings. In most cases, the resulting photo will be better than in-camera processing. The reason for this is that your computer has much greater processing power than the processor in your camera. While the camera internal processing program (its firmware) is infrequently updated, your RAW converter may be updated far more often, gaining an advantage using new know-how and better algorithms. In addition, you may have corrected some default settings of your RAW converter thus compensating or correcting some imperfections of your specific camera in specific shooting conditions.
- Save the RAW conversion settings so you may apply them later to all other files with the same or similar characteristics. Some converters, e. g. ACR, Capture One and RawShoooter, allow applying subsets of these settings, as well.
- At this time, select all files in a group and apply the same settings to them. You may now safely start batch processing your files. This is usually done in the background while you deal with editing for the next set.
  Concerning the settings for RAW conversion, you have several choices to choose from with most converters:
  – Use the camera profile default settings (these may or may not be modified from the original defaults)

- Use the original camera profile settings (those, shipped with the converter)
- Use settings previously applied to the individual files
- Use the settings of the previous conversion
- Use the settings of a (temporary) reference image
- Use some other saved settings

- When doing batch processing, you usually have a choice of where to write output files – either to the same directory as the source files or to a different destination directory. We prefer the latter, since it separates our working file set from the valuable originals (RAW files).
  Most RAW converters offer an effective method to naming (or renaming) output files although in practice, we rename our files before they are even seen by any RAW converter.

Some RAW converters discussed offer additional options for batch processing. For example some may produce several output files from each source file, for instance, a high resolution 16-bit TIFF to be used for fine-tuning and printing, as well as, a low-resolution JPEG file for use in a web presentation.

With most RAW converters you may choose if the batch processing will be done in the background (while you continue editing files) or at a later time. As processing many large files takes a toll concerning CPU and memory resources, it may be advantageous add files to a batch queue with the intention of processing at a later time. Don't be surprised if the performance of your computer slows noticeably while background processing is done (dual processor machines help considerably at this time).

It is recommended you convert RAW files into a new location (different folder). In this way, these files won't be inter-mixed with your current folder browser display. Also, there is no danger of accidentally overwriting source files (most converters prevent this with RAW files). Later, you may move or copy them back to the source folder manually using a script or via the batch renaming of the converter. Don't overlook defining a logical name scheme for the destination (converted) files. The RAW converter usually does that as part of the conversion process. Applying IPTC metadata to your RAW files (e.g. from ACR/Bridge) will save the labor of assigning this data to your converted files, as well.

Most RAW converters may be configured to open a converted image in Photoshop automatically, in batch processing this usually is not practical. We suggest you disable this option.

As mentioned earlier, batch processing is becoming more important. In Photoshop CS1 you had to write your own Photoshop action to open a file, make the various settings in Photoshop and save them, Photoshop CS2 comes preconfigured to do that. We see similar enhancements in batch processing in newer versions of other RAW converters, as well.

Apart from file conversion, simple file renaming is a frequently required batch operation. This can be done with one of the many renaming utilities (e.g. "Rname-it" or "Downloader Pro", both mentioned in chapter 3). Currently, however, renaming has become a basic function of most RAW converters. In Bridge, this function is found under Tools ▸ Batch Rename. The scheme for renaming is quite flexible and allows for the inclusion of text, date, various sequence numbers and some EXIF metadata in the file name (e.g. an Image-Unique ID). A file may also be copied or moved to a different folder.

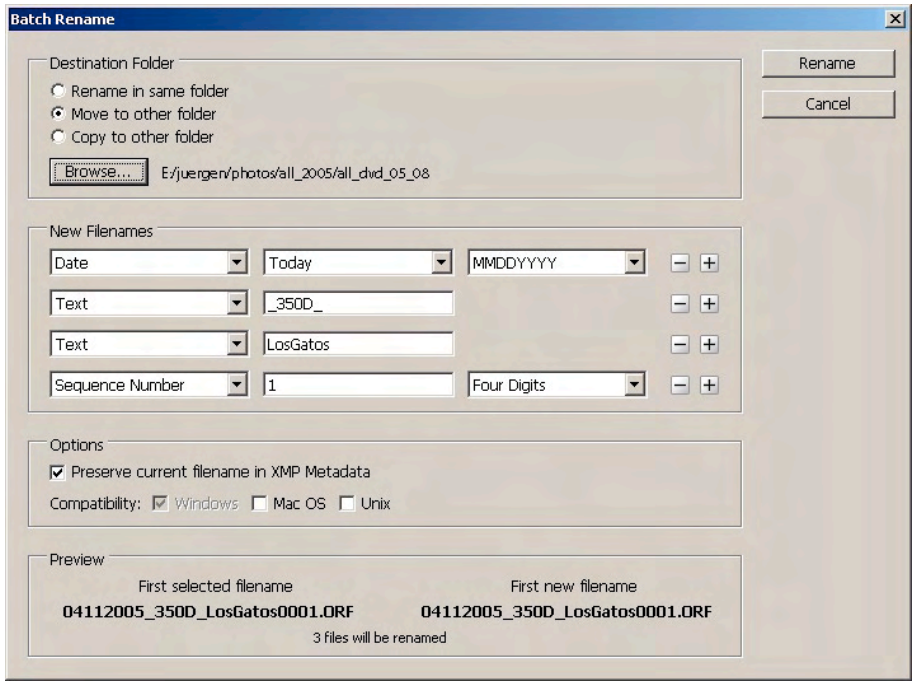


Figure 8-1: Batch-renaming dialog of Photoshop CS2

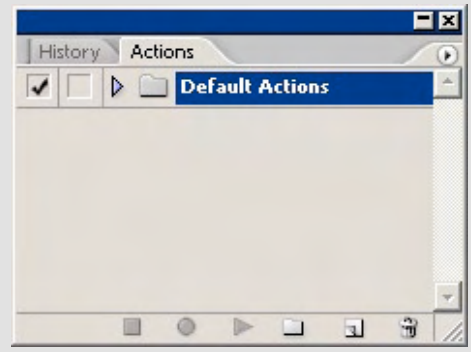
8.2 Batch Processing with Adobe Camera Raw

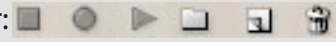
To convert a number of RAW files efficiently with Photoshop CS1 you must create your own Photoshop action. This action should open a file in ACR, apply all settings for the ACR workflow (selecting output Resolution, Depth, color Space, Size, …) start the conversion, make the setting for the target format, and finally save the file using the appropriate (preferred) image mode. Important in file saving is selecting an output file format and various settings for that specific file format. (The following is brief description how to create such an action. For more details, please refer to the Photoshop Help system).

How to create an action in Photoshop

Photoshop actions are very useful tools to do repetitive tasks. Creating a new action may be as easy as just recording the different Photoshop steps in your task. Thus, an action is a sequence of steps (such as opening a file or setting a new image mode) in Photoshop.

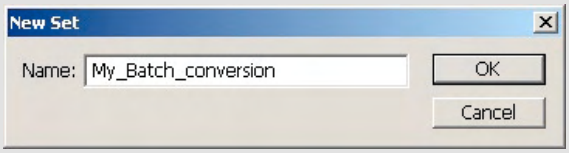
To create your new action, activate the action panel (Window ▸ Actions).



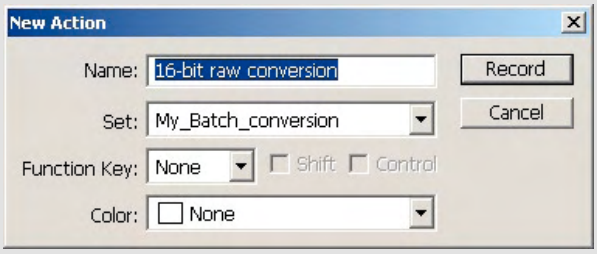
Before starting, have a look at the basic recording tools in the action button bar:  Their functions are (from the left to right):

- Stop recording
- Record button: shows "red" if Photoshop is recording an action and "green" when the recording is stopped.
- Replay action
- Create a new action set
- Create a new action
- Delete action or action step

To create an action for batch processing RAW files, first create a new action SET by clicking . Enter a descriptive name for this action set:



Select the new action set in the action panel and click to create a new action. This starts recording the following Photoshop steps. But, first a dialog appears, asking for a name for the new action. Lets us call it "*16-bit RAW conversion*".



The next steps to be recorded, done in Photoshop, are:

- Open a RAW file (File ▸ Open). It doesn't matter which file you open because its name will later on be replaced by the source selection).
- When Adobe Camera Raw appears, set all Work-flow Options you want to use for your batch conversion. From the ACR Settings menu, select the appropriate conversion settings set you plan to use in your batch.
- Click Open to start the conversion. The converted image will be opened in Photoshop.
- In Photoshop set the image mode you desire and add prototype adjustment layers (this, only useful, if you prepare your images for individual image corrections after the batch conversion is complete).
- Call up "Save as" (File ▸ Save as), select the appropriate file format (e.g. TIFF) and explicitly set all options and modes for your intended file format. The file name you give here

will be overwritten when the actual batch processing is performed.

- Close the Save dialog by clicking OK.
- Close the image window in Photoshop.

Click ■ to stop recording and thus finishing your action. Take a glimpse of the steps in your action by clicking at ▶ of your particular action in the action panel. You will see all steps and values chosen. Photoshop allows adding more steps, deleting or replacing steps. All this is well documented when you call up Photoshop Help.

You should now save your action set (select action panel, right-click on ▶ and select Save Actions).

To start batch processing with Photoshop, select File ▸ Automate ▸ Batch.

There are four sections in this dialog:

- Play for selecting the action-set and action.
- Source to select the source files.
- Destination to specify where the processed (converted) files should go.
- Errors-Handling

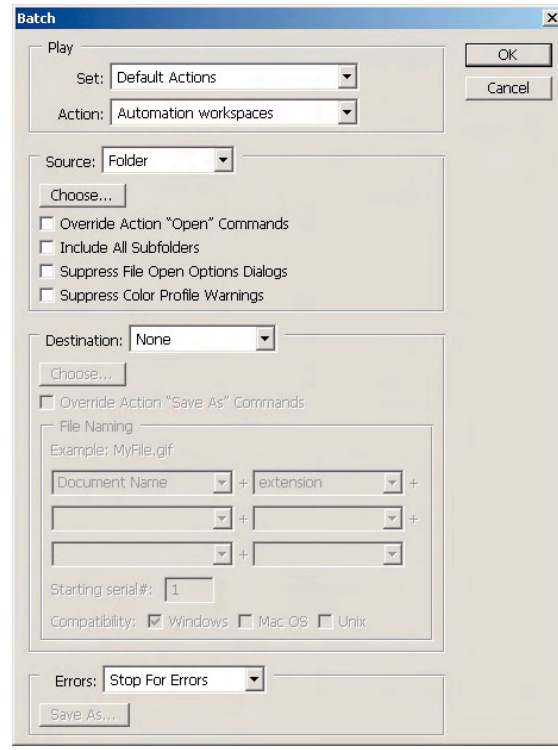
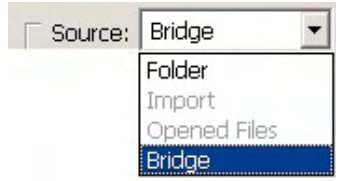


Figure 8-2: ▸ Batch dialog in Photoshop

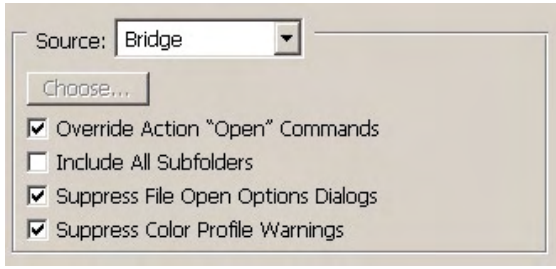
Section "Play" ▸ First, select the action set. An *action set* is a collection of different actions grouped into a set. To be listed in this pull-down menu, it should reside in the Photoshop default script folder.

You may, however, load additional scripts in Photoshop: Activate the action panel (Window ▸ Action). In that panel choose Load Actions from the drop-down menu. From the Set menu of the Batch dialog select the specific action you plan to use to process your source files.

Section "Source" ▸ In the source section is specified which files to process and how the processing should be done. Various source selections are available:



For this RAW conversion, only *Folder* or *Bridge* (or *File browser* with CS1) is of interest. Selecting Bridge processes those files selected in Bridge (or the Photoshop browser). Or, if you select Folder, all files in that folder (and optionally all files in its subfolders) are processed. In this case, you must select the source file folder by clicking the Choose button. In either case, we strongly recommend the following settings:



◂ *Figure 8-3: Suppress Open and Warning dialogs*

Override Action "Open" Commands will suppress the open dialog box as each source file is processed – it, nevertheless, will open each individual file. If you do not check this button, only that file will be opened which was in use when the batch script was recorded.

"**Include All Subfolders**" is optional and will do a recursive processing of all source subfolders, as well. We rarely use this option.

Suppress File Open Options Dialog suppresses the file Open dialog when opening individual source files.

Suppress Color Profile Warning suppresses a pop-up of the warning dialog if there is a mismatch of color profile of the converted file and current working space of Photoshop.

Section "Destination" ▸ Similarly to the source section, you specify your file destinations. They may either be written to the same folder

as the source files or to a different destination folder (which you are asked to select by clicking Choose).

Section "Errors" ▸ If an error occurs while processing the files, the processing may either stop (useful when debugging your scripts) or the error may be logged to a dedicated log file while processing continues with the next source file. The second option is preferable in the final, well-tested script.

Batch conversion using Bridge

Using CS2 and Bridge for a standard batch RAW conversion, it is unnecessary to build a Photoshop action. There is a simpler way:

- Select the files you want to convert within Bridge.
- Call up Tools ▸ Photoshop ▸ Imageporcessor. This brings up this dialog box:

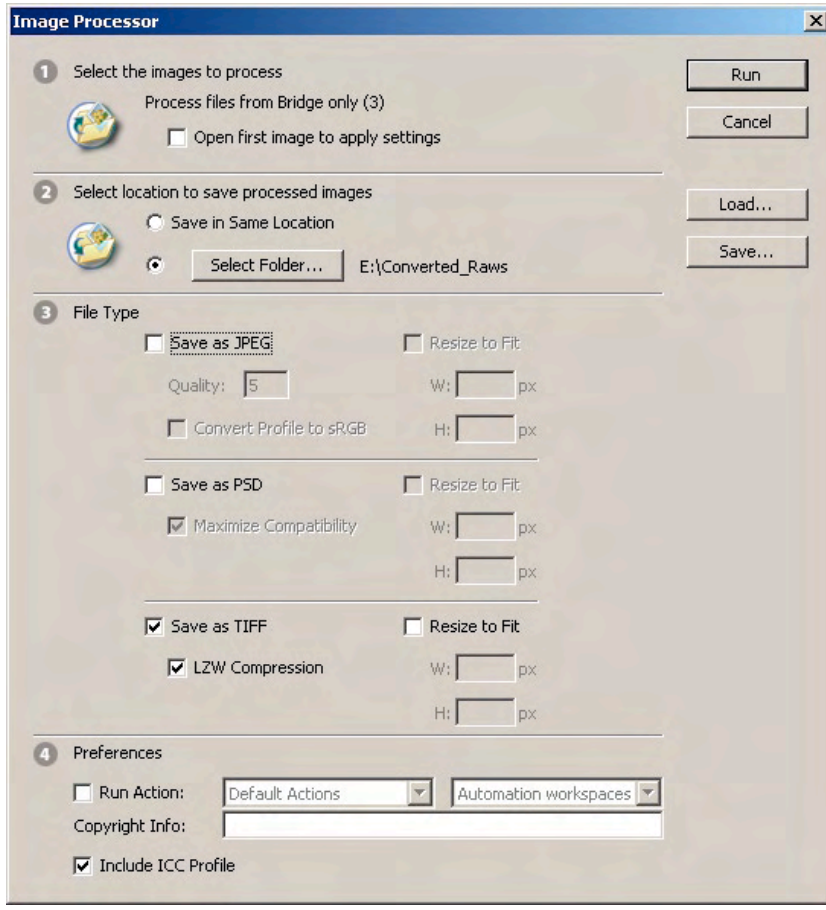


Figure 8–4: Batch conversion via "Image Processor" in Photoshop CS2

You probably already know the scheme:

① Open the first (additional) image in ACR and do the conversion settings to be applied to all selected files (1).
If you don't use this option, current settings of the individual selected files are used instead.

② Select the destination for converted RAW files.

③ Select a file format for converted files. You may generate JPEGs, as well as, PSDs or TIFFs – all simultaneously.
You may even resize the (converted) images.

④ You may select an additional Photoshop action to be applied to the converted file. The default action offers several different workspaces.
You should always include the ICC profile of your destination color workspace.

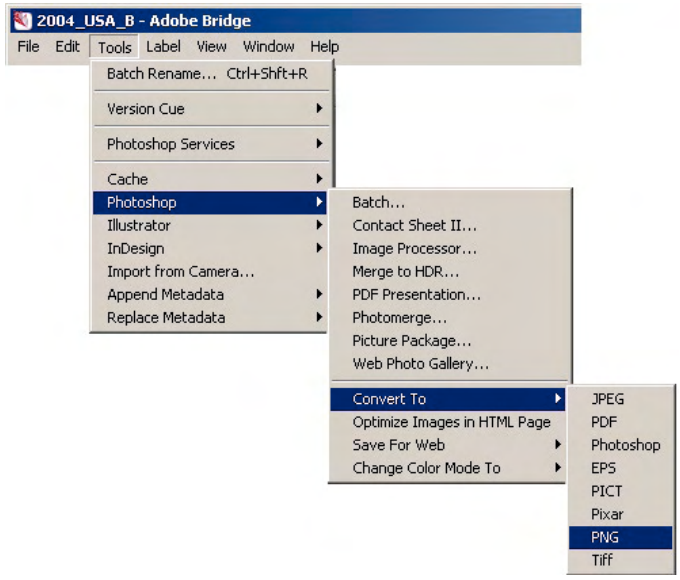
You may Save the current settings of this dialog box or may Load settings previously saved.

Clicking Run starts the conversion. If you selected the *Open first image to apply settings* (see area 1 of figure 8-4), ACR pops-up the Open dialog where you may select a RAW file. This RAW file will be open in ACR, and you may set up various ACR settings for image optimization. Clicking Open in ACR starts the conversion using the selected ACR settings for the selected file of the Open dialog as well as the previous files selected in Bridge.
The pictures will eventually display in Photoshop, yet no actions are required, and images are saved automatically.

Some Predefined scripts with Photoshop CS2 and Bridge

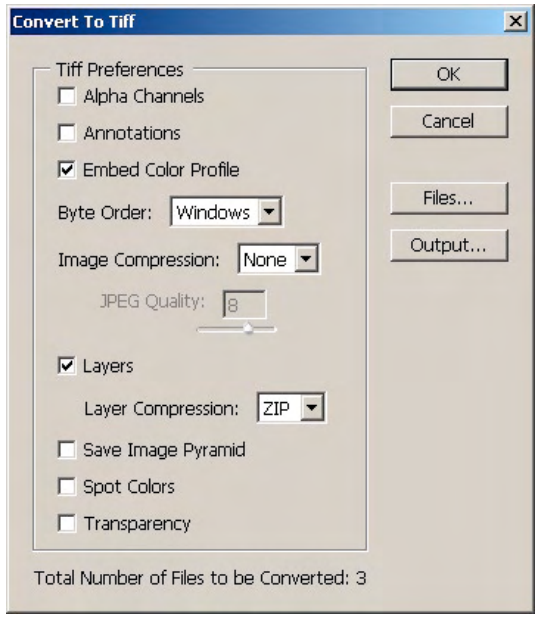
Photoshop CS2 ships with an assortment of preconfigured scripts to do batch conversion. If the scripts are to your liking (test them!), all you need to do is select the files to be converted in Bridge and call up the chosen conversion-function.

To select batch-conversion in Bridge, select Tools ▸ Photoshop ▸ Convert to. You may select one of the preconfigured destination file formats like JPEG, PDF, TIFF, …



◀ *Figure 8-5: Batch-scripts with Bridge (as part of CS 2 suite)*

A dialog will pop up, that allows you to do file format-specific settings (e. g. *Quality* for JPEG or embedding of an ICC profile). You may select further conversion parameters (e. g. destination folder, rename options by clicking the Output button) in the dialog.



◀ *Figure 8-6: Option when converting to TIFF using the "convert to" script.*

If the functions/scripts offered do not meet your requirements, or if you need additional scripts, you may design your own Photoshop actions and include them into the Bridge (or Photoshop) default script folder.

These predefined conversion scripts are available only in CS2 suite. Using only Photoshop or an additional component of the suite, may modify your tool menu (figure 8-5).

Simple Photoshop CS2 Batch Conversion Using Bridge

When using Bridge, you may proceed very similarly:

1. Select the files you want to convert within Bridge.
2. Shift-douple-click the previous file selected. This brings up ACR in the film-strip-mode.
3. Select the file you want to use as the reference for your settings. Do all corrections you wish to apply to this and the other images.
4. Now, select all files of the film strip (using the shift key) or click the Select All button (upper left corner).
5. The ACR Save button will change to "Save *n* images".
6. Clicking Synchronize will apply settings to all selected files.
7. Click Save *n* images. The dialog box of figure 8-7 pops up.

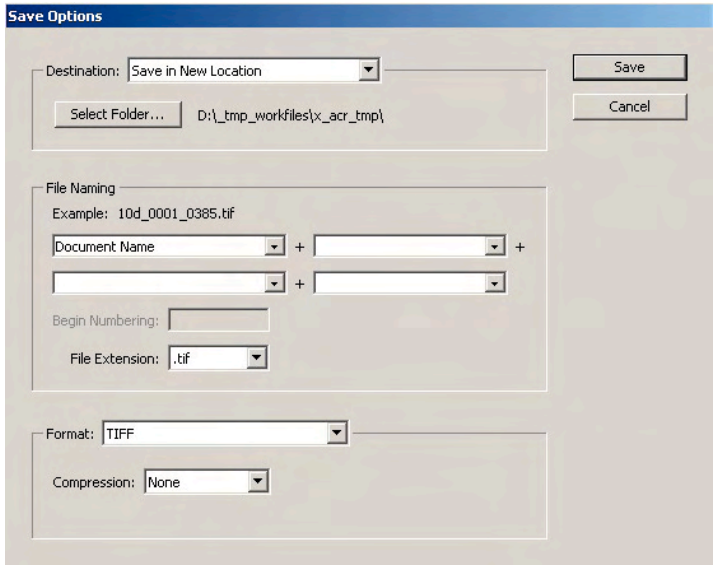


Figure 8-7

8. Clicking Save starts the actual batch conversion of selected files. ACR registers the status of the processing at the lower right corner of the ACR window, just above the Save button.

8.3 Smooth Batch Processing

There are several additional points you should learn to achieve painless batch processing. These points are valid not only for ACR but for other RAW converters, as well:

- Be sure the source files you want to process are correctly selected before activating a batch – either that you selected them with the file browser or Bridge (if that is, indeed, the source) or you selected the correct source folder.
- Make certain there is enough disc space for your converted files.
- Select a file naming scheme for your destinations files that avoids overwriting files with identical names.
- Disable various Open and Save (or Save As) dialogs and the warnings, as shown in figure 8-3 at page 8-8.
- If you have created your own batch scripts (recording Photoshop steps), you must explicitly set all parameters and settings in those Photoshop steps which are relevant for the conversion even when they are correctly set as you process your sample image (e. g. resolution, depth, space and output size or scaling and your output file format). When you call up the script next time, different settings may be in use, and result will be unpredictable output.
- If you use a script for your batch, test it thoroughly. Test it under different conditions, for instance, in cases where the output file already exists.

8.4 Batch Processing with Capture One Pro

Capture One Pro was one of the first RAW converters providing advanced batch processing, thus improving workflow with RAW files. We prefer to use Capture One in film-strip-mode while batch processing.

Principal settings for batch processing with Capture One are made in File ▸Preferences ▸Process Settings (see figure 8-8 at page 8-14).

It allows including a copyright note into the output files without calling up of the ITPC metadata dialog.

The main section for actual processing are found under the tab Process within the Capture One main window. Here, it is the section Batch Editor which controls batch processing.

This section (figure 8-9) shows icons to control the batch queue, and shows the current elements and state of the queue:

Adds the current image (or all images selected) to the batch queue. This does not start processing them.

Adds the current image (or all images selected) to the batch queue, initiating the processing of the file.

Removes a selected item from the batch queue.

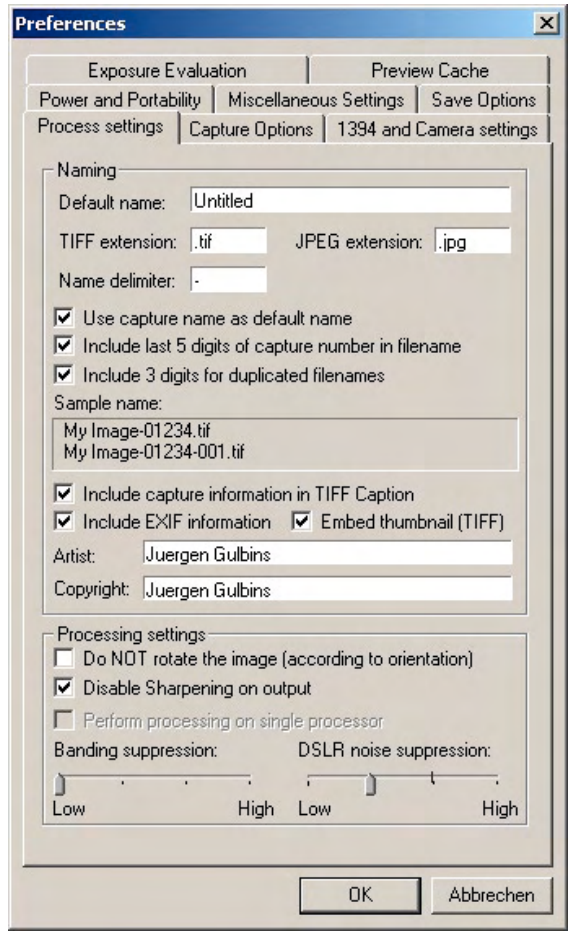


Figure 8-8: Batch-setup in Capture One Pro

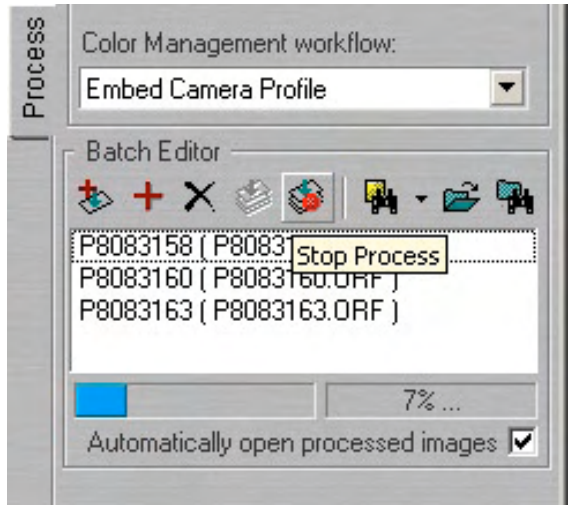


Figure 8-9: Batch Editor in Capture One Pro

Starts processing of the queue. The progression bar at the bottom of the sections will show the progress.

Stops processing of the batch queue. All items not yet processed remain in the queue.

Opens files recently processed via a drop-down list.

Allows selecting a different destination folder.

Opens the current processing folder for inspection.

When an item (image) is added to the batch queue, the settings from the process tab (e. g. Resolution, Depth, Size/Scaling, File format,) as well as all the conversion settings of the Capture, White Balance, Exposure and Focus tabs) are copied with the image-name as part of the conversion job ticket.

As in Photoshop, Capture One provides a rename function. To set it up, click . To start renaming, select files in the browser and click .

Though Capture One DSLR was one of the leading utilities concerning batch processing, it has fallen somewhat behind new releases of other converters. However, it is still fast compared to some converters and delivers very satisfactory image quality.

8.4 Batch Processing with RawShooter

Batch processing setup in RawShooter remains relatively simple. We prefer RawShooter in its film-strip-mode. The settings for processing are grouped under the Batch convert tab.

After applying the proper conversion settings (Correct tab), select the file or files you want to process, check your workflow parameter using the tab Batch convert and click Add.

This create job tickets for the batch conversion and adds them to the batch queue. The processing will only start when you click Go!. Once you begin the batch queue, all items of the queue are processed as quickly as possible until you stop batch processing by clicking Stop (which has appeared during an active batch queue instead of Go!).

A status bar shows progress of the individual conversions. All items processed will be removed from the batch queue. As with all other RAW converters, original RAW files will not be modified or touched. There is a button to call up the dialog for Naming and output location. Locate opens the destination folder containing converted files using the file browser of the operating system.

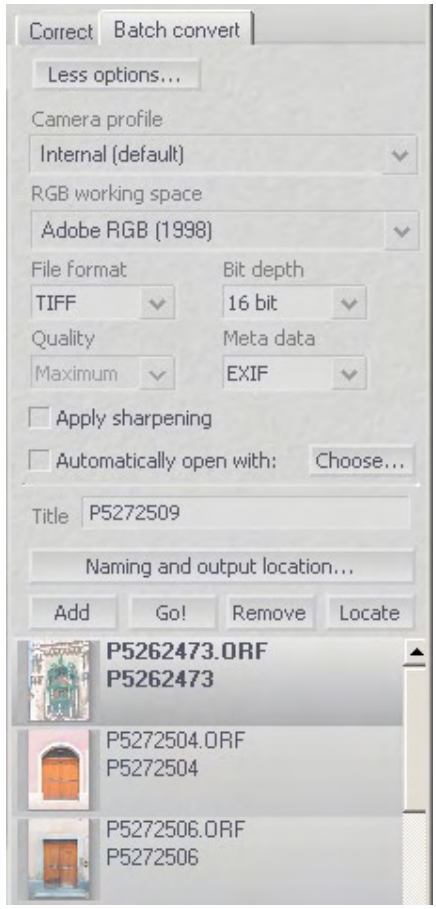


Figure 8-10: Batch-convert tab of RS

Chapter 9

DNG – Digital Negative Format

Camera: Olympus E-20P

9.1 DNG – its potentials

As of mid-2004, each manufacturer of digital SLRs had its own proprietary RAW format – moreover, most had several (somewhat) unique RAW formats for different camera models. For photographers using more than one camera, this was a real nuisance. Software companies, which intend to process RAW format files, must provide a broad, ever-increasing range of conversion routines as part of their software. Each time a new camera hits the market, they

have to evaluate its specific RAW format and often must adapt and enhance their converters. To print-shops, studios and others handling digital data, the large variety of RAW formats remains a serious problem, and processing becomes costly.

Having implemented Adobe Camera Raw, one of the best RAW converters of the market, supporting a broad range of RAW formats (as of this writing, about 60 formats), Adobe has a rich experience with RAW conversion. To support the multitude of formats with Camera Raw, Adobe takes a two-step approach. The first is to convert the proprietary RAW data into a universal internal RAW format. The actual conversion from RAW to JPEG or TIFF is done from an intermediate format. The multitude of formats supported by Adobe camera RAW, provides Adobe with a very good insight of the general requirements of a universal RAW format. Having this record of quite useful and universal format experience (PostScript, PDF, XMP, …), Adobe began to specify a generalized format for RAW photo data. The result was the introduction of Digital Negative Format (DNG) at the Photokina exhibition, 2004. Its purpose is to provide a universal container for RAW photo data and is partly derived from TIFF EP, a format used by other RAW formats, as well. DNG likely bears a resemblance to the internal intermediate format of ACR, but it is an external file format. Apart from the actual RAW data – the data read from the camera sensor – and the well known metadata, such as EXIF and ITPC (see chapter 10), it allows embedding proprietary data of the camera maker (Adobe calls it *private data*), as well.

Though introduced and controlled by Adobe, DNG is an open format – well, as of now, half open. It is open in the sense that it is well specified, documented, and its specification is published, something that is not true for most of the various proprietary RAW formats.

DNG holds three promises:

- It may be used as an exchange format for RAW photo data, used whenever necessary to provide RAW files to a service or person, who cannot (or does not wish to) process the proprietary format of your camera.
- It may be used as an archival format for RAW photo data.
  If the specific proprietary RAW format of the camera used in the shooting is no longer supported, or the conversion to a standard format is no longer optimized (while the general optimization of

the RAW data using the Bayern pattern continues), RAW files archived as DNG will probably still be accessible and their access should improve over time.

- DNG may replace some proprietary RAW formats or preclude introduction of additional new formats, thus reducing the jumble of different formats you may handle.

While not all of these predictions will come true immediately, DNG is a promising newcomer. Already, some advantages are obvious.

DNG as an exchange format ▸To use DNG as an exchange format today is quite simple. Adobe offers a free Raw to DNG converter (DNGC for short) on its web home page ([45]). It is available for Windows and Mac OS and can handle the conversion of complete folders (see section 9.2). All cameras supported by Adobe Camera Raw are also supported by DNG converter. Rather than handing-off photos to others in a proprietary RAW file format, it is probably advisable to supply your data using DNG (unless JPEG or TIFF is the appropriate format). As the range of formats supported by Adobe Camera Raw is extended, support will also extend for DNGC.

DNG as an exchange or archival format is not only supported by Adobe, but most other providers of RAW converters have picked up support for DNG, including Phase One (with Capture One) and Raw Shooter. Most software companies supporting RAW format for asset management systems, now support DNG or will do so soon. So, if your favorite tool does not yet support your specific RAW format, you may convert it to DNG using DNGC. Doing this, you will be able to include those images into your picture database or use them with a special filter or other tool designed for working on RAW files.

There is yet another advantage in using DNG. As there is (internally) a clear separation of photo data and metadata (see chapter 10), if you change settings in the preview of a RAW converter (e.g. Adobe Camera Raw or RawShooter), these new settings need not be stored on a separate sidecar file, but may be included into the dng-RAW-file without actually modifying the original photographic information (sensor readouts).

DNG as an archival RAW format ▸ As PDFs, are an answer to many archiving problems troubling companies storing their office documents, DNG may be the answer for archival of RAW photo data. As with PDF however, this may not solve all problems nor be the best

solution in every case but definitely should be seriously considered as a long-term archival format for RAW photo data. Adobe will most likely not go out of business for some time. If that should happen (unlikely as that may be), numerous other RAW converters are supporting the conversion from DNG to JPEG, TIFF or other standard formats to come.

The Digital Negative specification provides for not only all pixel information stored in current RAW formats, but also for all additional, proprietary metadata that many manufacturers include. Note, however, that the current release of the Adobe DNG Converter may, in some cases, ignore a portion of proprietary metadata, and include only basic information required for creating a high-quality image file. For this reason, using this release of the Adobe DNG Converter for archival purposes, it is recommended you save your Digital Negative files in addition to the original RAW files created by the camera.

DNG as native camera RAW **format** ▸ When DNG was introduced by Adobe in 2004, many photographers wondered whether camera manufacturers might pick up DNG as their native camera RAW format. It seems obvious that smaller companies and new market entries would be the likely early adopters, while the main stream industry, such as Canon, Nikon and Minolta have invested too many resources into their formats and tools to switch any time soon. As it turned out, it didn't take long before some companies committed to DNG. Early 2005, Hasselblad and Leica announced their commitment and will support DNG as native camera RAW format.

DNG definitely will not be the only solution to the dilemma of a wide variety of RAW formats. In the future, a real RAW format standard will probably be defined by a standards organization, such as ISO or ANSI. Then, Adobe will probably propose DNG as a standard. Today however, DNG is an important step toward reduction of the format variety in RAW photo data. As with PDF, DNG will undergo enhancements over the years and will be extended to pick up new features of futures camera techniques.

It is too soon to judge the success of DNG or its part in the format gamble. However, it exists, is easy to use and well supported. It may be a reasonable solution when you want to pass RAW data to outside parties. DNG may offer a good solution, if you want to use some special software on RAW data not supporting your specific

RAW format, or when you wish to save an additional copy of your RAW data, using DNG, for archival purposes.

As of today, however, we would not recommend conversion of all RAW data to DNG then delete original files (though DNG files may include your original RAW data), but would recommend its use for exchanging RAW files with other parties.

9.2 Usage of the Adobe DNG Converter

The Adobe DNG converter (DNGC for short) may be downloaded free of charge from Adobe's Internet Home Page ([45]). It has multiple functions, outlined above.

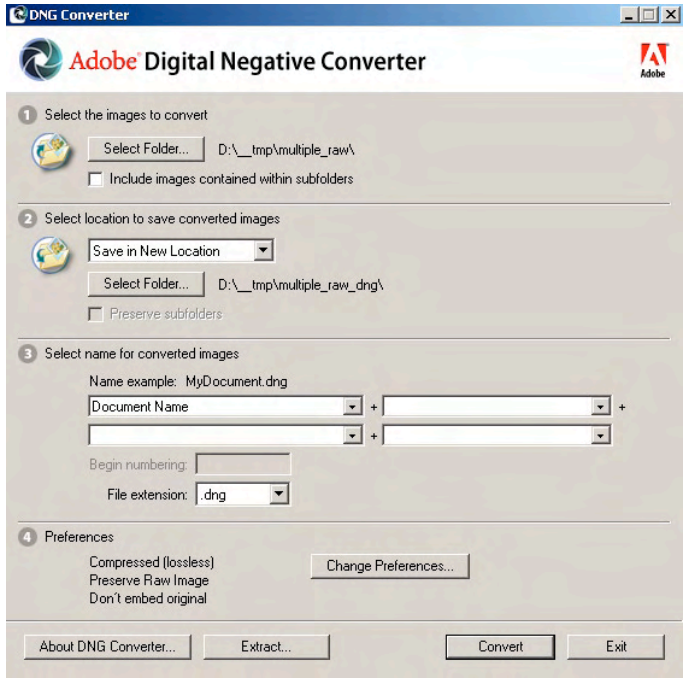
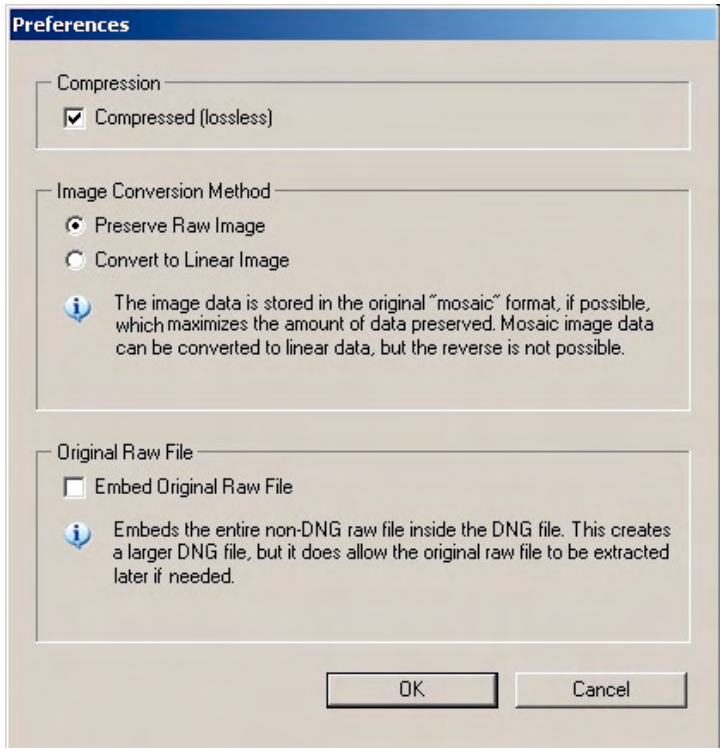


Figure 9-1: DNG dialog to convert a complete folder of RAW files

The interface is uncomplicated, and you will be wise to keep in mind, that its task is to convert an entire folder of RAW files, not just a single one.

In section ① , you specify the folder in which RAW input files requiring conversion reside. Section ② indicates where the generated dng files will go. Parameters of section ③ define the naming conventions of the newly-generated dng files. Parameters of sec-

tion ④ specify, how the conversion will be done. Clicking on Change Preferences brings up the following dialog box:


Preferences
Compression
Compressed (lossless)
Image Conversion Method
Preserve Raw Image
Convert to Linear Image
The image data is stored in the original "mosaic" format, if possible, which maximizes the amount of data preserved. Mosaic image data can be converted to linear data, but the reverse is not possible.
Original Raw File
Embed Original Raw File
Embeds the entire non-DNG raw file inside the DNG file. This creates a larger DNG file, but it does allow the original raw file to be extracted later if needed.
OK
Cancel

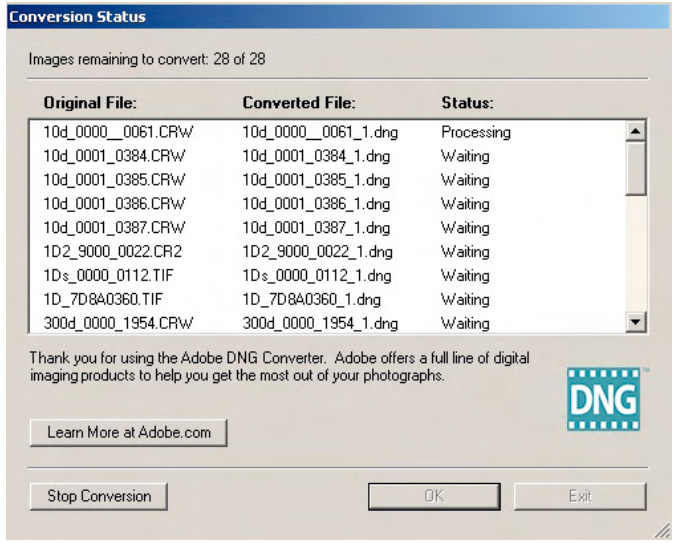
◂ *Figure 9-2: DNG Preferences*

Compressed ▸ should always be used since it is a lossless compression, reducing about 10–65 % from files sizes.

Image Conversion method ▸ There are two ways to do the conversion: retaining the original RAW data – usually the data of the Bayern pattern sensor data – and a conversion to a linear picture. In most cases, the first method is preferred. As improvements in the Bayer pattern interpretation (also called *demosaicing*) come along, you still retain original data and may apply any improved algorithm to that data. As significant improvements were implemented in the past couple of years, more may be expected. Converting to a linear form actually performs an interpolation of the Bayer pattern (exception: RAW files from a camera with a Foveon-based sensor). In doing this method, some potential of your RAW negative is lost if you want to go return to the original RAW data. Additionally, file size increases by about 60 to 300 % (the linear version holds RGB data, while native RAW format stores but one pixel value per sensor element).

Original Raw File ▸ You may embed the complete and original RAW file into a dng file, essentially making dng into a wrapper for your RAW data. You may extract the original file from the dng file (to extract such a file, activate he button Extract at the bottom of the conversion dialog box).

Clicking Convert initiates batch conversion. DNGC is quite fast, but converting many large files still takes time. Progress is indicated in a separate window. Stop the conversion by clicking Stop Conversion.



◂ *Figure 9-3: DNG Conversion Status*

As with original RAW files, DNG files may be used as input to RAW converters. If you attempt to open a dng file using Photoshop, it will launch Adobe Camera Raw to do the conversion from DNG to standard image format, as described in chapter 4. The dng file includes all metadata, such as EXIF and ITPC data, embedded in the original RAW file. It may not, however, contain some undocumented proprietary parts whose meaning is known only to the manufacturer of the camera. To keep that data, as well, you must embed the original data in dng, hoping that its meaning will be known to Adobe (or possibly another provider of a RAW converter) to be released at a future date.

If you use Photoshop CS2 (Photoshop 9) or later, there would normally be no need to use DNGC, because Adobe Camera Raw 3.x produces DNG files, as well. In this instance, it is simpler to call up ACR via Bridge and use ACR for the conversion.

9.3 Advantages and disadvantages of converting to DNG

Adobe's DNG converter runs smoothly and fast. However if you already have dng files in your source folder, DNGC converts them as well, which usually makes little sense. When we tested the converter, dng files could be opened by Photoshop CS1 (aka PS 8) and Photoshop CS2 (aka PS9). As of this writing, C1 and Raw Shooter, Nikon Capture 4.1, Canon Digital Photo Professional and Bibble did not support DNG. Many Viewers and DAMS (*Digital Asset Management Systems*) supporting RAW files did support DNG (e.g. ThumbsPlus, Extensis PORTFOLIO, iView Media Pro), but an updated version of their RAW converter plug-ins may need to be downloaded.

Using lossless compression, dng files are usually smaller than original RAW files, depending upon the RAW format used. While with Nikon .NEF files tend to gain about 10%, with my Olympus .ORF files (from a Olympus E-20P DSLR) dng file size was about 1/3 the original Olympus file size! This factor may be an additional advantage when storing files on a CD/DVD or when transferring RAW files via the Internet. If compression is not activated, however, the dng file is usually larger than the original file – up to 2 times. For that reason alone, we do not recommend using this option.

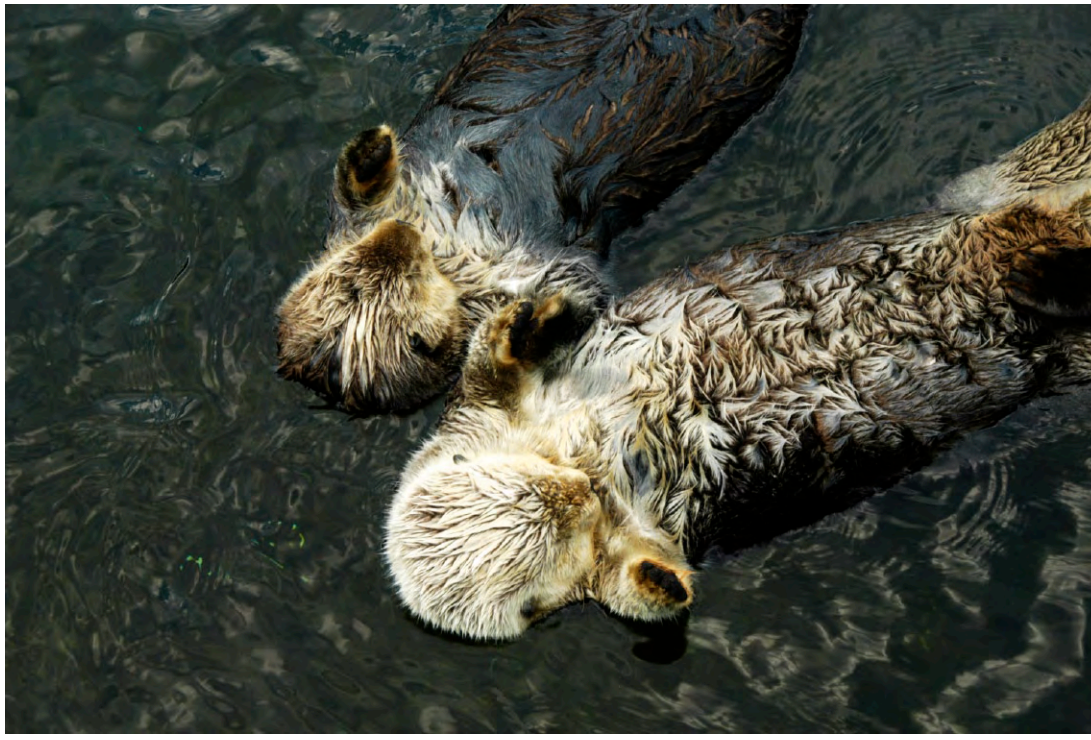
Adobe supports new cameras very soon after they are on the market. So, in some cases, converting those RAW files to dng may allow them to be correctly handled by other applications working with RAW files – such as, asset management systems (ThumbsPlus, Portfolio, iView MediaPro, …) or special stand- alone filters such as DxO – which do not yet (or never will) support your specific RAW file format.

Exchanging RAW files as dng with outside parties, such as print shops, may be another usage, though, to date, most print shops and similar services prefer TIFFs or JPEGs.

Converting from a proprietary RAW format to DNG is clearly an additional step in your workflow. DNGC does not yet support hot folders (watched folders). So, each time new RAW files are imported, you must call up DNGC. This may become automated using a script, but you still have to deal with them. Until now, all RAW formats supported by DNGC are also supported by Adobe Camera Raw. So, there is currently no real advantage to using DNG locally. Exchange of RAW data, clearly demonstrates its advantages.

Chapter 10

Metadata



Camera: Nikon 100D

10.1 Metadata for Photographs

Metadata provides descriptions with data. Using digital photography, metadata describes an actual photo taken. Metadata may be embedded in the actual data file or may be stored separately – either in a discreet file or in a database. With RAW files, TIFFs and JPEGs, we actually find several types of metadata:

- File attributes
- EXIF information
- ITPC information

- Further metadata such as
  - RAW conversion settings (e.g. embedded in XMP),
  - JPEG comments,
  - Preview icons and preview images,
  - Keywords,
  - Classification data etc. (partly stored in an image database).

File attributes ▸ The file system stores metadata, such as filename and file type (given by its extension), (file) creation and modification date, access rights, file length, etc. This metadata is determined by the camera, and, later on, by your operating system, the RAW converter or other applications. Aside from the file name and type, and to a lesser extent, the creation date, this data is of no great concern or information value to the photographer. Some cameras include information as part of the file name, e.g. the creation date.

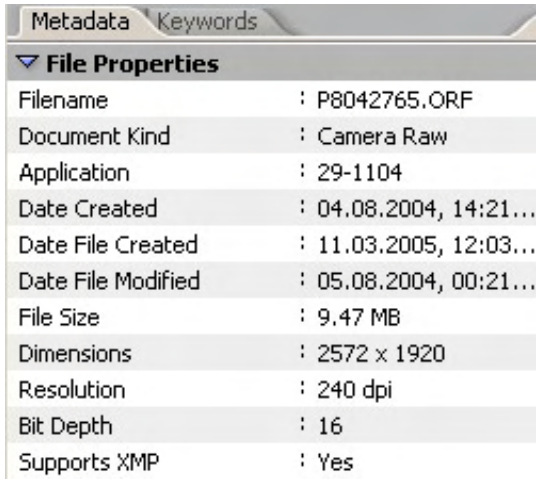


Figure 10-1: File Properties in Bridge

EXIF information ▸ The EXIF data (*EXchange Image Format for Digital Still Cameras*) is created by the camera and includes settings used when the picture was taken. You find information on the camera maker and model, aperture and shutter speed, ISO settings, type of lens, focal length used and if a flash was active. It includes the date and time of the shooting, as well as the metering mode used, white balance and

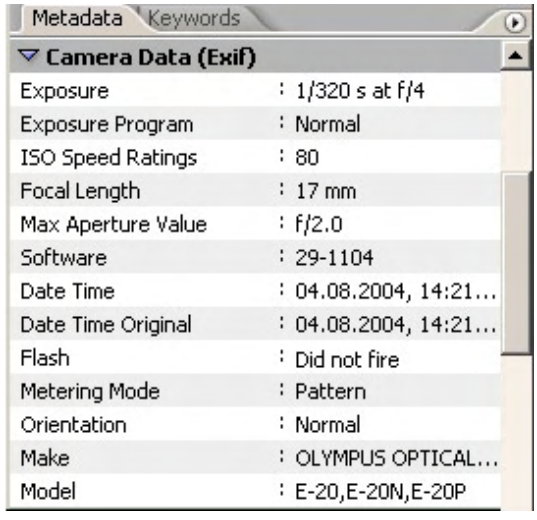


Figure 10-2: EXIF data in Bridge

color space settings, the camera program used and the resolution of the photograph. It may even contain the location of the shot via GPS data (e.g. for the Nikon D2X there is an optional GPS module available to record current GPS coordinates. This is included into the EXIF data of the camera). There are many more data, EXIF can store. The EXIF specification also allows for addition proprietary fields. All these values are recorded when the picture is taken and embedded into the data file, be it JPEG, TIFF or RAW.

This EXIF data is not only valuable to the photographer, but is also used by the RAW converter, by optimizing applications, such as the lens correction software PTLens or DxO ([34]) or by the firmware of inktjet printers when (automatically) optimizing pictures for output. (This optimization may be suppressed by explicitly suppressing automatic optimization with your print job or by an EXIF flag, indicating that the picture was optimized by some other applications previously, for instance Photoshop).

Normally there is little need for a user to change this information. Consequently, neither ACR, C1 nor DPP provide this change function. If, however, the date and time for shooting is not set correctly, you may wish to eventually make such a correction. If you do, you may use a special application, such as Exifer ([35]) or ACDSee ([36]).

IPTC (International Press Telecommunication Council) ▸ This type of data has been in use for some time with photographers shooting press-related material. It was defined by the International Press Telecommunication Council, and permits inclusion of copyright notices, author, title, a short subject description and keywords for retrieval. This metadata is very DRM (*Digital Rights Management*) oriented; it however does not embed a watermark into the file.

Though these ITPC fields are present in pictures coming out of the camera or RAW converter, they are usually empty. They must be filled in by the user. Photoshop provides a function to do that.

Additional metadata ▸ While there is a well-accepted standard for EXIF and ITPC, you may find a multitude of additional metadata.

Adobe defined XMP (*Extensible Metadata Platform*) for the metadata exchange between applications. XMP is widely used in Adobe applications, such as Acrobat, Photoshop, Illustrator, InDesign and others. XMP is XML based and open (its specifications are published, and it is supported by the IETF). XMP data may be

embedded into your data file or may be stored in a separate file. XMP is quite flexible and may contain predefined fields, as well as user-defined fields. With Adobe Camera Raw, the settings for RAW conversion are embedded in an XMP file. Photoshop (and Version Cue) may even include a version history in the XMP file of a picture. Other makers of RAW converters store such information using a different format. RawShooter Essentials, stores these settings in files using the file extension .rws (inside a subfolder *.RWSSettings* in the folder containing the RAW files). These files are in a binary format. RawShooter supports having several setting files for one RAW file and you may choose which settings to use for the conversion.

Further metadata on your photos may be stored in a separate database, often the case when you manage pictures using a digital asset management system (DAMS) such as Extensis Portfolio, iView Media Pro, ThumbsPlus or one of the other numerous asset management utilities, professional document or content management systems. While using an asset management system, you may usually add keywords, categories and further classifications. These metadata are normally stored only in the database of the DAMS. If you use a DAMS to administrate your images, make certain your DAMS is importing those EXIF- and IPTC-fields, since you will likely use them for searching into their database. Searching a database is much faster than opening individual files to read data.

There are some overlapping fields within different metadata sets. For example, ITPC, as well as EXIF, provide a field for the title (or name) for your picture. You may also include it as a JPEG comment (not so on RAW files). For that reason, you should decide where you want to include this data. Redundancy often leads to conflicts and errors.

Another type of metadata not mentioned above, are ICC profiles. Profiles defines how the color (pixel) values of the image are to be interpreted (see chapter 11). At present, ICC profiles are not part of RAW files, but must be attached (embedded) to photographs when they emerge from the RAW converter and should stay with the file ever after. Files containing embedded ICC profiles are called *ICC tagged files*.

All of the RAW converters discussed handle EXIF and IPTC metadata and tag-converted files with the appropriate ICC profile. Again, at

present, XMP usage is mainly restricted to Adobe applications. All these metadata can be quite useful and important to you. Their usefulness increases over time as more and more applications come along, taking advantage of such metadata information. Bridge, for example, lets you search and sort files by much of the metadata mentioned (not only with photo files, but other Adobe application files, as well).

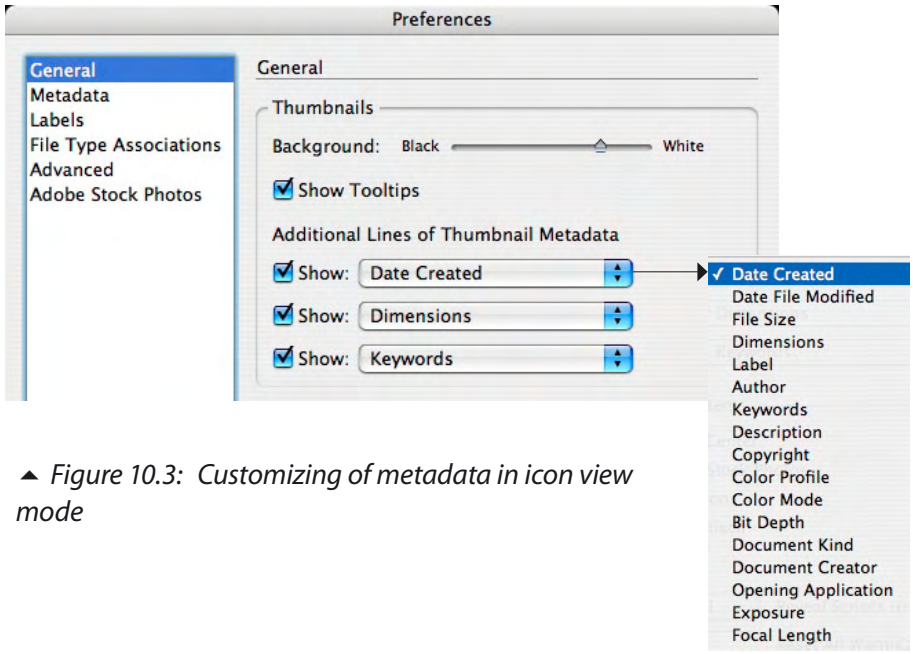
An example: If you browse your picture files using the Photoshop CS1 file browser or Bridge (part of Photoshop CS2) and change the white balance of a RAW data file (even without actually converting the RAW file), those changes are saved and stored as XMP data either embedded into the RAW file or as separate "sidecar files". Since RAW files are considered sacrosanct (never to be modified), any additions or modifications of metadata are stored in separate files by ACR, Bridge or RawShooter. When using DNG (see chapter 8), metadata, such as conversion settings, may be embedded, as DNG provides a clear, well-defined structure for accomplishing this.

Concerning display, editing and usage of metadata, Bridge, ACR and Photoshop Elements are the most advanced of the set of applications we deal with in this book. Using a digital asset management system, you will find more advanced features for metadata handling.

10.2 Metadata usage in Adobe Camera Raw and Bridge

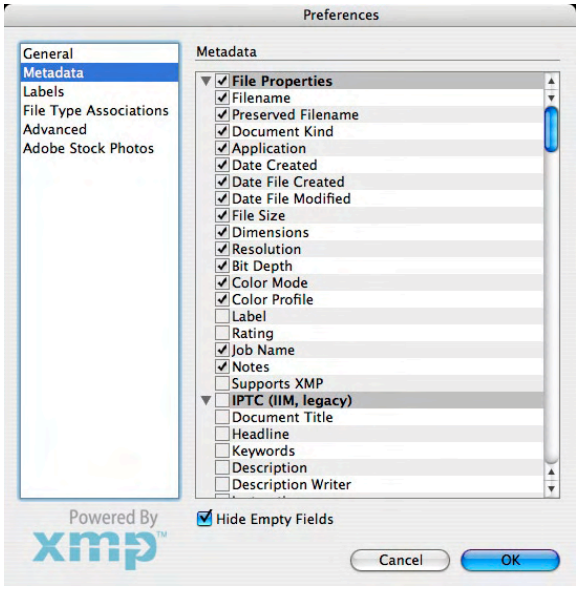
Adobe applications are making increasing use of metadata. Both Photoshop file browser or Bridge display some metadata as part of the image icon list and even more as part of the metadata preview window. The (almost) complete range of metadata is displayed, when you call up the File Info window.

Using Bridge or the file browser of Photoshop CS1, you may customize which metadata is displayed with the preview icons of the browser and what kind of metadata is visible at the metadata panel of the browser (see figure 10-1 at page 10.6). This configuration (customizing) is done via Edit ▸ Preferences. (Mac: Bridge ▸ Preferences). To customize information display with the preview icon, select General.



▲ *Figure 10.3: Customizing of metadata in icon view mode*

To determine, which metadata is displayed in the Metadata Area of the file browser, go to Edit ▸ Preferences ▸ Metadata. Again, the metadata fields are grouped by file properties, IPTC Data and EXIF Data. Additionally, you may activate a display of edit history. Labels and ratings associated with a picture file are part of the file's metadata, as well.



◀ *Figure 10.4: Customizing of metadata in icon view mode* ▼

As said previously, all ITPC data must be entered manually. You may do this at the metadata area of the file browser. Click on one of the ITPC fields marked by a ✎ and enter the value for that field. Pressing ↵ will write the data into the file.

Alternatively, you may call up the metadata window by right-clicking the mouse button and selecting File Info. Though keywords are part of the ITPC set, with Photoshop file browser or Bridge, you must use the Keywords panel to edit and enter them.

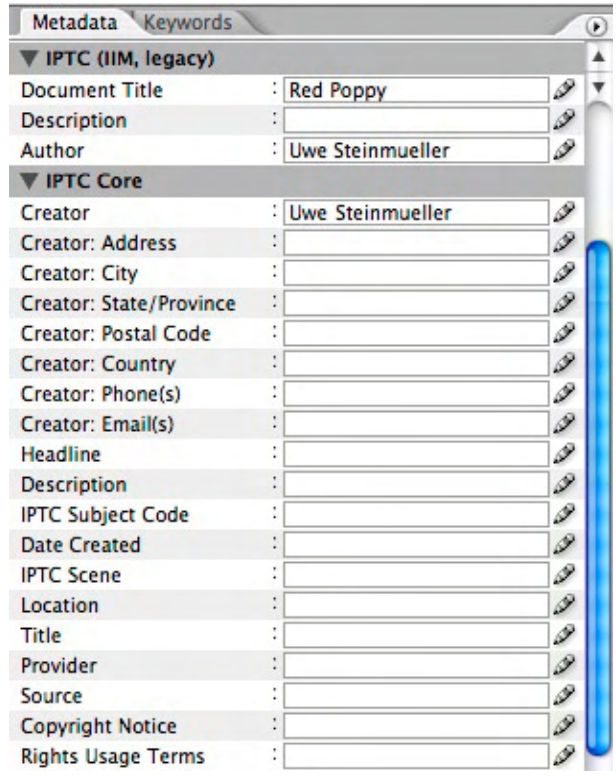
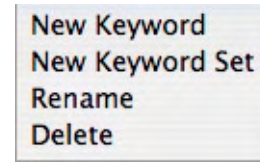


Figure 10-5: ITPC data may be edited

Keywords may be grouped in sets. If you apply a set to a file, all keywords of that set are included in the metadata. You may, however, select only one or more keywords of the set and apply them. If you delete a keyword or a set from the keyword panel, or if you change the keyword name, it will not change the keyword data of all those files that have those keywords previously assigned.

To rename, delete or create a new keyword or set, go via the ▸ menu of the keyword panel or call up the menu via the right mouse button while the mouse cursor is over a keyword field.



If you select several files (preview icons) and edit the ITPC or keyword metadata, new values are applied (added) to all selected

files. The panel in this case will usually display *(Multiple values)*, to indicate, that the data values of the selected files differ.

If you want to apply the same ITPC data to several files, e.g. name, copyright, URL and your address – this is an uphill task. Bridge, however, allows applying a metadata template to the files selected in the browser windows. To do this, first apply the metadata to a single file and save this data to a separate metadata file (…/File Info ▸ Advanced ▸ Save). Next, select the files you want to provide with the same metadata inside the file browser and apply the saved metadata to the files via …/File Info ▸ Advanceds ▸ Append, selecting the name of the metadata previously saved in the upcoming dialog box. Using Replace instead of Append will replace all of your file metadata with the fields set in the template.

XMP files are Unicode text files. So, you may view their content by simply opening the XMP file using an ordinary text (Unicode-enabled) editor, where you may edit its content. This allows creating your own metadata templates, e. g. for an easy assignment of copyright information to photographs or even creating your own customized File Info panel (a description for this can be found at [43]). However, the basic structure of the file should not be altered. Conserve the correct XML/XMP syntax.

With Photoshop, Bridge and ACR, there are two ways to store metadata not embedded in an image file:

- at the ACR database or
- inside a separate XMP file, called a "sidecar file" by Adobe.

Both methods have their benefits and their pitfalls. Storing external metadata in the ACR database file will result in a very compact, central solution. There are two disadvantages of this central database, however:

- If you move your directory with picture files or rename your picture file, the connection between the picture file and its external metadata is broken, and it is difficult to recreate that connection. Any renaming using the Photoshop file browser or Bridge, the association is maintained. But, there is no function to move a file or complete directory of files within Bridge or Photoshop CS1 file browser (except drag and drop).

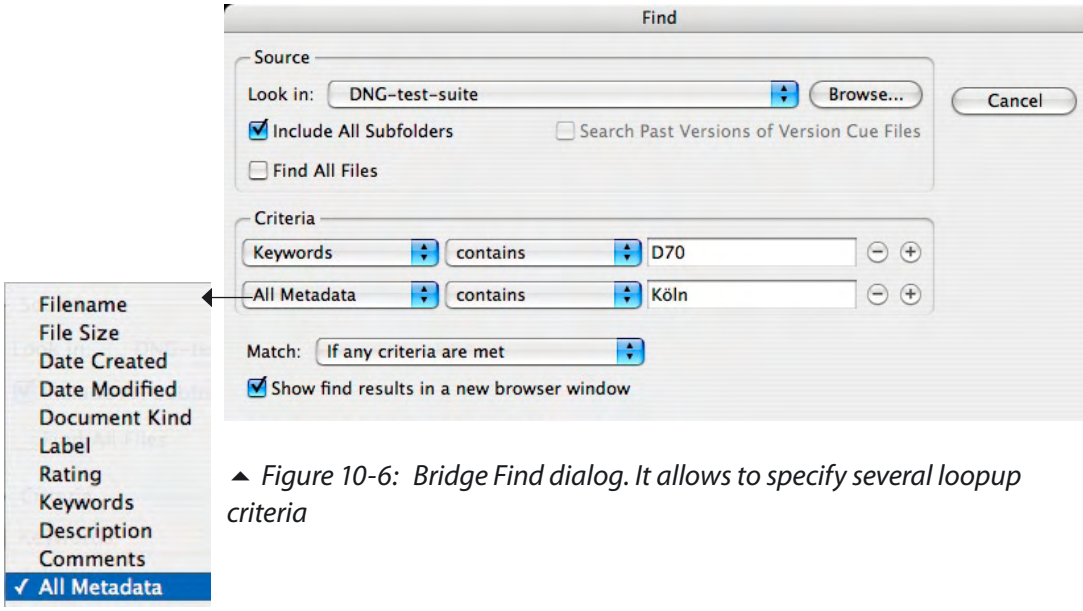
- Storing metadata in an XMP sidecar file adds an additional XMP file (name.xmp) for each picture file. It resides in the same directory as the RAW file, and contains metadata, as well as the RAW conversion settings of the image file. As long as you rename your image file or move it using the Photoshop file browser or Bridge, the sidecar file will be renamed, copied or moved consistently. If you do these operations using different tools, you must make allowances for the sidecar file.

We prefer the second method because it allows moving whole folders, including the metadata information, as well as archiving a folder while easily including metadata with the folder (e.g. on a CD or DVD).

The scheme is very similar with the other RAW converters and file browsers, though they use different file and folder names.

10.3 Retrieving files by searching for metadata

An important benefit of metadata is its use for sorting and retrieval. With PS file browser or Bridge, you call up the find dialog box via Edit ▸ Find or via Ctrl+F (Mac: ⌘+F). Here, you may include several metadata characteristics into your search criteria:



▲ *Figure 10-6: Bridge Find dialog. It allows to specify several loopup criteria*

The files fitting the search criteria are grouped in a temporary set.

The search function for metadata is not available (as of now) with RawShooter, Capture One, Bibble, Nikon Capture or DPP. However you may find these with asset management systems like ThumbsPlus, Extensis or iView – provided they included that specific metadata into their database when importing the image files. While Photoshop searches for data in its cache or by reading the metadata section of the files, asset management systems look it up in their database, usually much faster if a large number of files are handled. You should, however, be sure that the metadata you will likely use for searching is included in the DAMS database when importing your images into these systems. This may have to be configured when customizing your DAMS (*digital asset management system*).

Chapter 11

Profiling and calibrating for your RAW Converter

Camera: Olympus E1

11.1 The problem with camera profiles

In chapter one and two, we emphasized the importance of ICC profiles. What was said is true for monitors, scanners and printers. But, profiling is useful for digital cameras as well. Cameras, however, present a problem:

When you profile a device, the first step is to define the relevant parameters, light being one of the most important. When you profile

a scanner, the light source remains the same (you only differentiate between reflective and transparencies). With printers, D50 (daylight at 5,000 Kelvin) is the standard light source for evaluating and judging prints. Cameras however, encounter varying light conditions, e.g. night shots, morning light, sunny or cloudy). For this reason, profiling your cameras is practical only if you shoot in only one or just a few different lighting conditions, such as may be the case when shooting in a studio.

If all this holds true, the scheme for profiling can be quite simple and similar to other device profiling:

- Shoot a camera target using the same lighting conditions you propose to use with photographs. Use those camera settings (e. g. resolution, white balance, exposure, …) you will (most likely) use later for shooting. Your target must have uniform lighting. The hardest part is to get even lighting avoiding reflections with color targets with glossy patches.
- Import the image of the camera target into your profiling software. Doing this avoids any color correction and much of the processing (you need to use a RAW converter if the target shot is a RAW file). In some cases, correcting white balance may be helpful.
- Your profiling software compares the colors appearing on the image of the target with known color values of the target and calculates the camera ICC profile from that.
  Keep in mind however, that this ICC profile is only valid for the camera you used for shooting **and** only for pictures taken with identical (or quite similar) lighting conditions used when shooting the target originally.

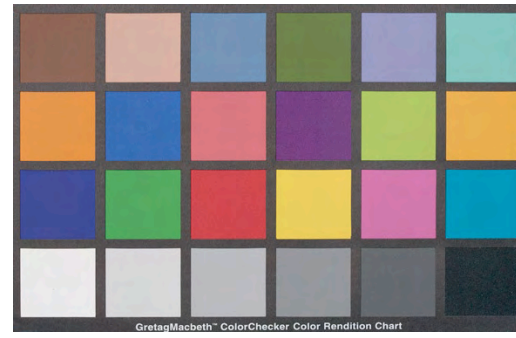
If you are shooting TIFFs or JPEGs, apply this profile to your photograph when opening the image in Photoshop. If you shoot RAW files, the RAW converter should accommodate camera profiles. Only RSE, C1 and Bibble do this.

All RAW converters we consider in the book provide their own, generic internal profiles for the cameras they support. Usually, several shots are taken with a specific camera while using different lighting conditions. From these photos, an averaged profile is calculated (with additional tweaking). White balance control of your RAW converter allows white balance of your image to shift along the axis between the profiles for low color and high color temperature.

There are several packages to accommodate camera profiling – e. g. the module *Camera* by Gretag Macbeth ([15]), *inCamera* by PictoColor ([24]), or *Profile Prism* by Digital Domain ([33]).

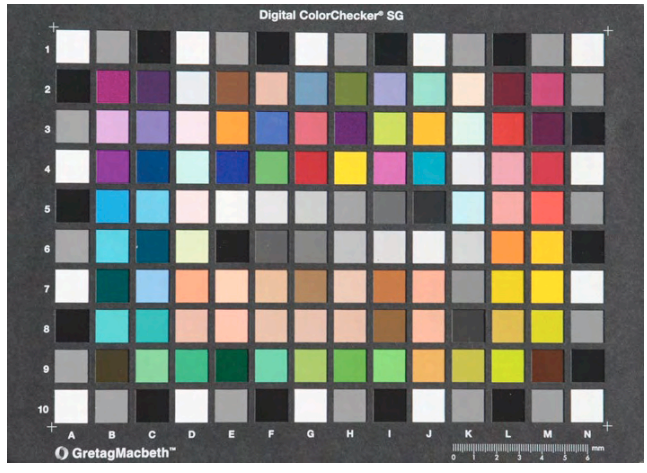
11.2 Camera profiling using Eye-One Photo and ProfileMaker

GretagMacbeth ([15]) offers Camera, a package consisting of a camera target and a software module called *ProfileMaker 5*. Camera is sold as a standalone package or as part of different *Eye-One* packages – e.g. Eye-One Photo. Gretag's Camera – supporting Windows as well as Mac OS – including a small (4 x 5 Inch) camera target *MiniColorChecker*.



Figur 11-1: GretagMacBeth MiniColorChecker

For serious camera profiling, however, you should consider ColorChecker SG, which may be ordered separately. It is larger, has many more patches and allows better profiles. It does come with a fierce price tag (around 300 US Dollars or Euro plus tax).



◀ *Figure 11-2: Gretag MacBeth ColorChecker SG, an excellent camera target*

Despite this, it is of excellent color quality, quite robust and the colors should not fade for a long time, even when used in bright light.

The color patches show very little metamerism in varying lighting conditions.

To profile a camera using Eye-One Camera, follow these steps:

1. Take a picture of the target – we recommend *ColorChecker SG* – using the same lighting condition you use for a shooting session. Continue with your shooting and do the profiling before you process your images of that shooting session.

2. Convert your target image using standard settings with your RAW converter, then convert to a TIFF file. If you usually work with 16-bit TIFFs, convert the target image as a 16-bit TIFF, as well.

3. Start **ProfileMaker 5** and select Camera.

Figure 11-3 ▸: Starting dialog of ProfileMaker 5.0

4. From the drop-down list labelled Reference Data select the type of target used.

5. With the drop-down list Photographed Testchart selected, press Open. Navigate to the image of the target shot.

6. ProfileMaker will show the target image in a new window.

Figure 11-4: Target image that has to be cropped

Carefully crop it, using the mouse with a cross hair cursor and the . Better to crop a bit tight than to include white surrounding space. You may even crop into the target area, if the image shows a perspective view.

7. Compare your target image with the image of the reference target. If their orientation and pattern of patches are the same, proceed.

8. From the drop-down menu Photo Task select the type of picture you took, and then from the drop-down menu Light Source select the type of lighting condition used for shooting.

9. The Options found in the dialog box with Photo Task Options let you tweak your profile for special lighting and color conditions.

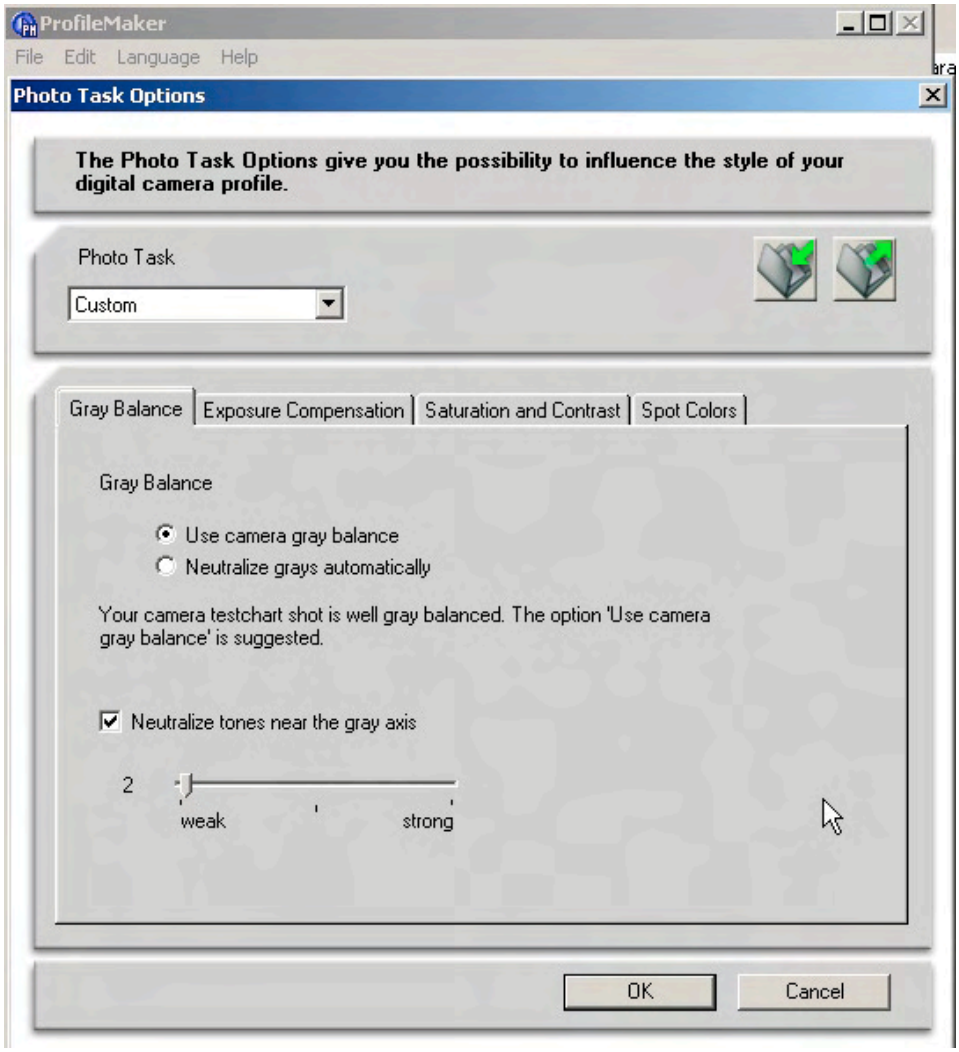


Figure 11-5: Several options allow to adapt your camera profile to specific needs

These should be used only if you have prior experience in profiling.

10. Clicking Start initiates the generation of the profile. You may see some messages, advising that the image is over- or underexposed. Ignore them.

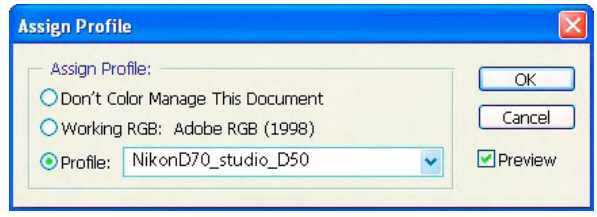
11. Provide a descriptive name for the profile, naming the camera and lighting conditions, (e.g. Nikon-*D70_Studio_D50*).

That's it! This profile may be used as a camera ICC profile with C1 or RSE or may be assigned to a converted image using Photoshop.

If your RAW converter does not support custom camera profiles, you should consider converting your RAW files without doing much color correction with the converter. Apply the generated profile to your converted TIFF or JPEG file using Photoshop:

1. Open the converted image with Photoshop, avoiding any profile conversion while opening.

2. Select Image ▸ Mode ▸ Assign Profile from the menu (PS 9): Edit ▸ Assign Profile). From the drop-down menu of profiles, select the camera custom profile you generated using ProfileMaker for lighting conditions used for the shooting.



◂ *Figure 11-6: Assign your camera profile in Photoshop*

If you checked Preview in your Assign Profile dialog box, you will see the effect of the selected camera profile even before you click OK. Clicking OK will perform assignment of the camera profile.

11.3 Camera profiling using InCamera.

InCamera is a Photoshop plugin allowing users to create camera profiles. We recommend InCamera mainly for studio profiles in which you control the light consistently.

1. Convert your RAW file with a RAW converter (e.g. RSE) in the mode required for creation of camera profiles (see the documentation)

2. Open the converted file into Photoshop (do not color manage).

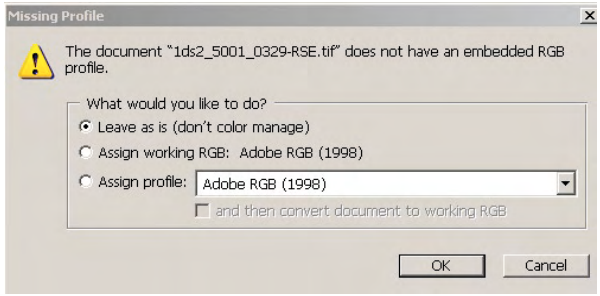

Missing Profile
The document "1ds2_5001_0329-RSE.tif" does not have an embedded RGB profile.
What would you like to do?
Leave as is (don't color manage)
Assign working RGB: Adobe RGB (1998)
Assign profile:
Adobe RGB (1998)
and then convert document to working RGB
OK
Cancel

Figure 11-7: Ignore Color Management for this image (at the time beeing).

3. Run the InCamera plug-in and adjust the grid to match the target.

Figure 11-8: Adjust the grid to match the target in InCamera.

4. Click on Check Capture.
   InCamera lets you check for even lighting of your target.

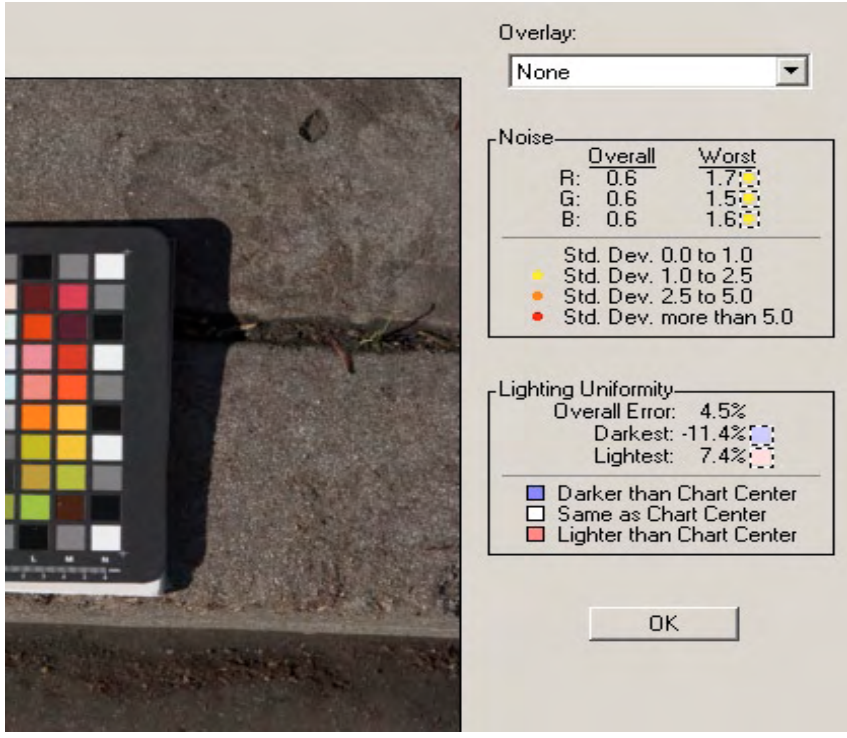


Figure 11-9: Check for even lighting

As mentioned before. Providing good even lighting is an art. A good profile depends on shooting good target shots.

5. Now, you just click OK and InCamera will save a ready-to-use camera profile.

11.4 Shooting for a neutral gray

When shooting in abnormal lighting conditions, often the case when shooting outdoors or outside a controlled studio with well controlled lights, an ICC camera profile is of little use. However, there are some ways to work around this problem. One reason for profiling is to achieve a correct white balance (not always what you want, e.g. when setting up soft or colored lights within a studio to achieve an intentional special mood). In this situation, there is an easy and universal solution, though possibly not achieving the same exact colors that may be accomplished using a camera profile:

Shoot a color checker or gray card with right along your subject. Use its neutral gray patches as the reference point for your white balance. If you shoot a series of pictures with the same lightning conditions, include the color checker in only the first shot. Then apply the white balance of this image to all the other images of your session – so long as lighting conditions do not change.

◀ *Figure 11-10: Shoot a color reference or a gray card with your first image.*

There are many gray cards and color checkers available, however not all provide a truly neutral gray patch. In our experience, Mini ColorChecker by GretagMacbeth is quite good – though not cheap (about 60–75 US dollars).

To utilize the patches of a gray card or ColorChecker for white balancing, follow these steps:

1. Open the image (see cropped view) with your RAW converter, e.g. ACR, and activate the tab for the white balance.

2. Pick up the eyedropper and select the gray patch on your color checker (with MiniColorChecker by

GretagMacbeth, it is the second patch from the left in the bottom line – see figure 11-10).

This sets your white balance, which should be nearly neutral by now. If you save this setting and apply it to the other pictures taken with the same lighting conditions, you should get good white balanced result for all of them.

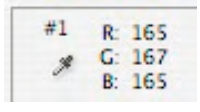
11.5 Calibrating Adobe Camera Raw

While Adobe Camera Raw does not support custom camera profiles, it does provide controls and settings for special color corrections. This allows you to basically build special profiles (at least something resembling custom profiles) for your camera. If your camera tends to over-saturate red or cyan, for example – more than other cameras of the same make and model – you might correct this in one image, then make it the default color setting for the camera.

We recommend against using these settings to correct individual shots, but to use only as a generic correction for a specific camera. You may, however, use different settings for different light conditions.

These setting are located within the ACR tab Calibrate.

Use these sliders with care and watch closely their visible effect in the preview window. Use a correctly-exposed picture to do the calibration. It should show some neutral light gray areas where color-cast are easily detected. Set several measure points with the eyedropper in these areas and try to obtain equal RGB values there:



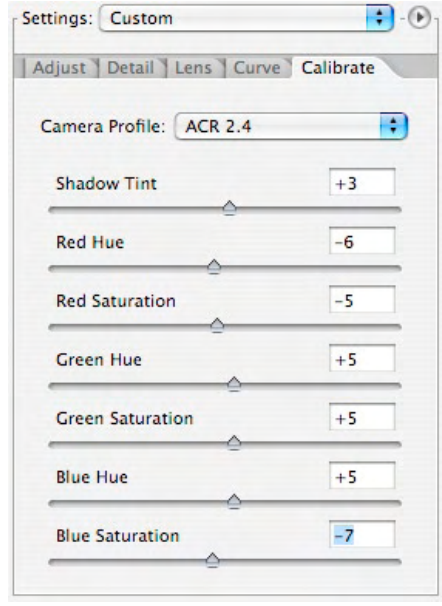
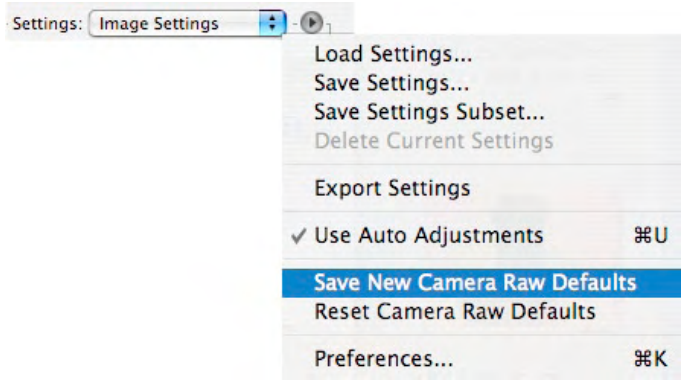


Figure 11-11: Profiling with Calibrate

You may use these calibration settings as new camera defaults. ACR will use them for only a specific camera make and model – including all cameras of this type. To use as camera defaults, save the setting via Save New Camera Raw Defaults in the save setting menu:



◂ *Figure 11-12: Save your current settings as new camera defaults.*

Alternatively, you may save settings as a special file to be loaded again, in which case you should probably save the Calibrate settings as a subset (Save Settings Subset ▸ Calibration). Adobe stores the settings as .xmp files.

The default folder for that is *C:\ Documents and Settings\ user\Application Data\ Adobe\Camera Raw\Settings* (or Mac: *user*/Library/ Application Support/Adobe/ /Camera Raw/Settings).

If you stay with that folder, these settings will be listed in the ACR Image Settings drop-down menu and may be recalled with-minimum navigating.

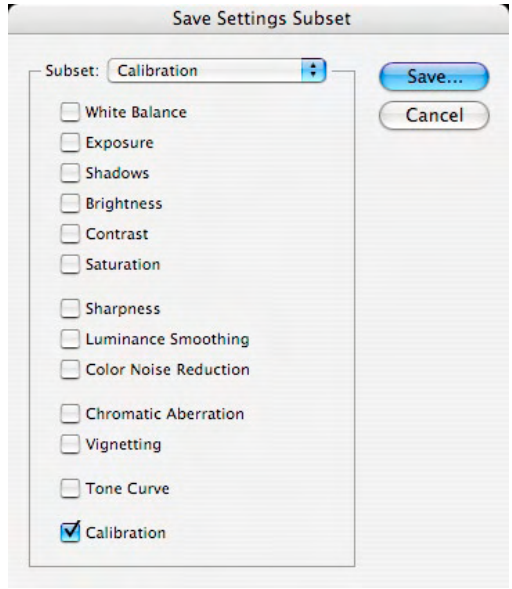


Figure 11-13: ACR allows to selectively save your settings

Going a step further, instead of a good gray color balance, you may read out the color values on your target using a spectrophotometer (e. g. Eye-One Pro), set some color checkpoints with the ACR eyedropper at the color patches.

If you have no spectrophotometer, use the patch-values measured with our Mini-ColorChecker (see figure 11-14).

Figure 11-14: Gretag MiniColorChecker with the rounded Lab (L) and RGB (R) (Adobe RGB) patch color values

Try tuning the calibration settings, so that the readouts achieve target color values of the various patches. This must be done iteratively, since changing one color will change other colors, as well and things can get tedious. Don't attempt matching all patches, rather focus on the three or four patch colors important to you, (e. g. skin colored patches or perhaps the blues). Remember that RGB values are color space dependent! Those RGB values given in the image shown are those or Adobe RGB (1989).

Results you achieve using this method are generally better than merely setting a neutral white/gray balance.

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Chapter 12

Creating B&W photos from color images

Camera: Canon 1DS

12.1 Turn color images into Black & White

When everybody is shooting in color, Black & White Photography may seem a dying art. We, however, are convinced, that for some scenes and some shooting, B & W is still sensible, sometimes even superior. With B & W, the photographer, as well as the viewer, has to

concentrate on shapes and contrast. B & W permits reducing the message to the most essential parts of the picture while drawing attention to those parts – you have to go for a strong abstraction with your photograph. Though some digital cameras allow shooting in B & W, we recommend shooting in color and do the reduction to B & W either in the RAW converter or in Photoshop (or similar image editor). Thus, converting color images to B & W has great potential. Still, merely converting an image from RGB mode to grayscale mode does not (in most cases) do the trick. This method usually results in a flat picture without high impact.

Shooting with B & W film has a long and well-established tradition, so, let us have a glance at what a workflow with B & W film looks like then compare to steps used with digital B & W processing.

B & W film	B & W with Digital Camera and Photoshop
Real world in color	Real world in color
Camera Filter (red, orange, yellow, green, …)	Digital color image (TIFF or JPEG from your RAW converter)
B & W film spectral sensitivity	Photo Filters in Photoshop
Developer	B & W Channel Mixer in PS
Negative	All techniques about contrast, brightness, shadows and highlights
B & W print (paper grades, dodge and burn)	Dodge and burn in Photoshop
	Digital B & W print

Figure 12-1: Similarities and differences between B&W film and B&W digital images

Setting up our digital B & W workflow, we want to come as close as possible to the simulation of these classic B & W techniques.

12.2 B & W workflow with ACR, Capture One and RawShooter

When looking into B & W, we love the power of abstraction that B & W provides. But we might not be alone in the observation that working in color (have a look at our color work at [5]) and B & W requires very different thinking and, more importantly, a different feeling.

In fact, during the process of creating effective B & W photos we can get distracted by any color we see (especially of the same photo). What we want to do is think in B & W only.

Color conversion techniques

There are endless methods of conversion color to B & W, and most are based on Photoshop:

- Channel Mixer (full Photoshop only, not in Elements)
- Hue/Saturation desaturated
- Photoshop plug-ins
- Converting to grayscale in the RAW converter (Adobe Camera Raw, Capture One DSLR)

Probably nothing beats the power of all these techniques, but all require switching from color to B & W and, thus, detract from our pure B & W viewing process.

We have developed a pure B & W workflow with ACR, Capture One and RawShooter. This includes even thumbnails and previews in B & W.

B & W with ACR

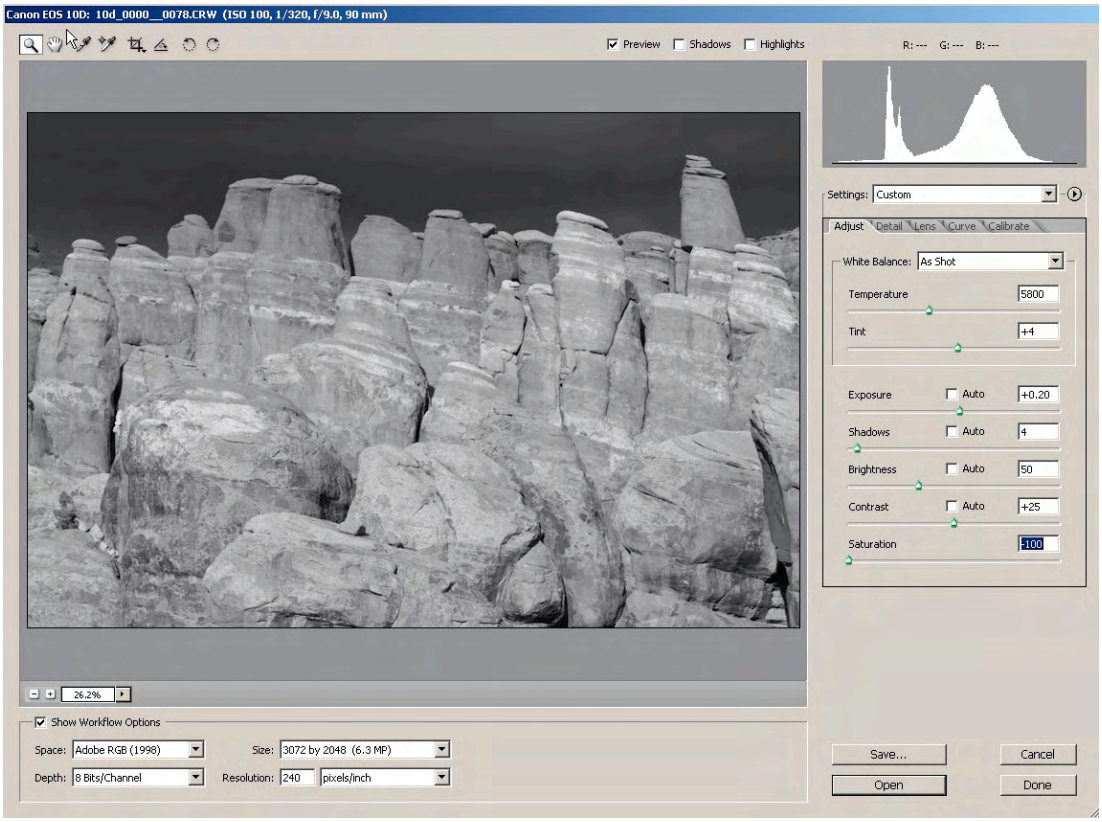


Figure 12-2: Setting Saturation to zero will display your images in Black & White.

Creating B & W images with ACR is pretty easy. Just set saturation to zero. You than can manipulate tonality using:

- White balance (WB)
- Calibration data

Once you have a file converted and open in Photoshop CS, change its mode to "Grayscale" and open the Shadow/Highlight tool.

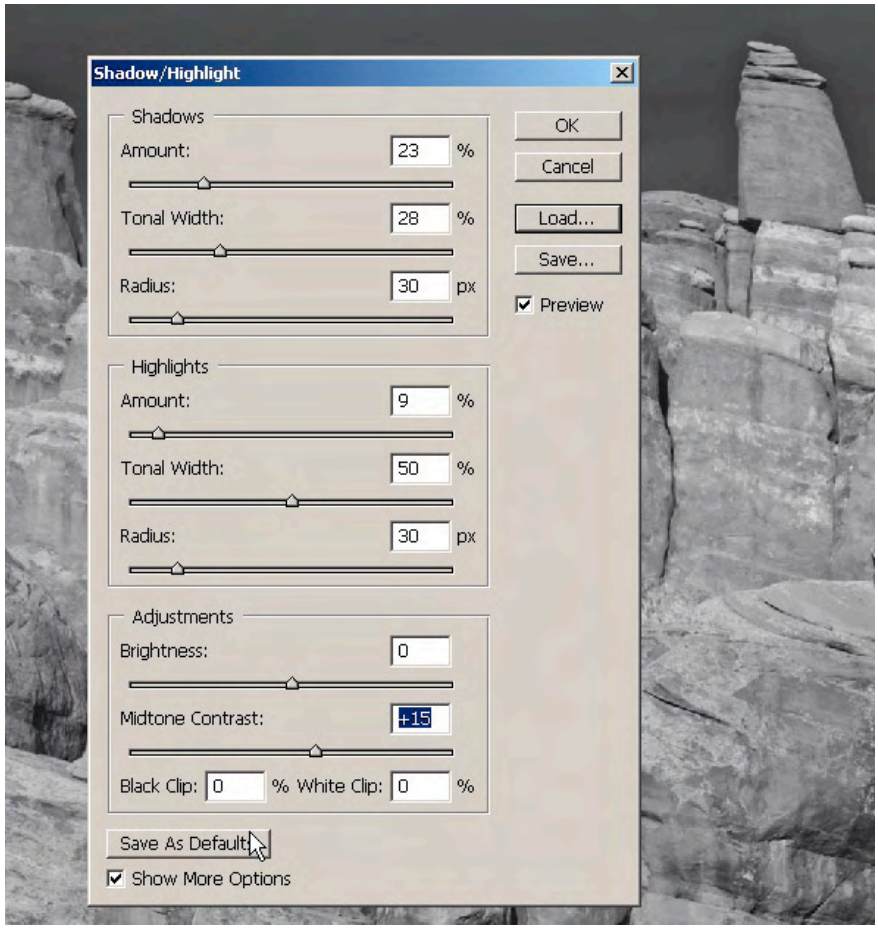


Figure 12-3: You may optimize your image using Photoshop's Shadow/Highlight *function.*

Shadow/Highlight provides the ultimate control for tweaking your B&W tonality. For grayscale images the "Color Correction" slider turns into a "Brightness" slider. It is all there:

- Open up shadows
- Tone down highlights
- Enhance mid-tone contrast
- Optimize brightness

B&W thumbnails and previews

Then, apply saturation settings to all the pictures you want to convert to B&W, and even thumbnails and preview images show up in B&W:

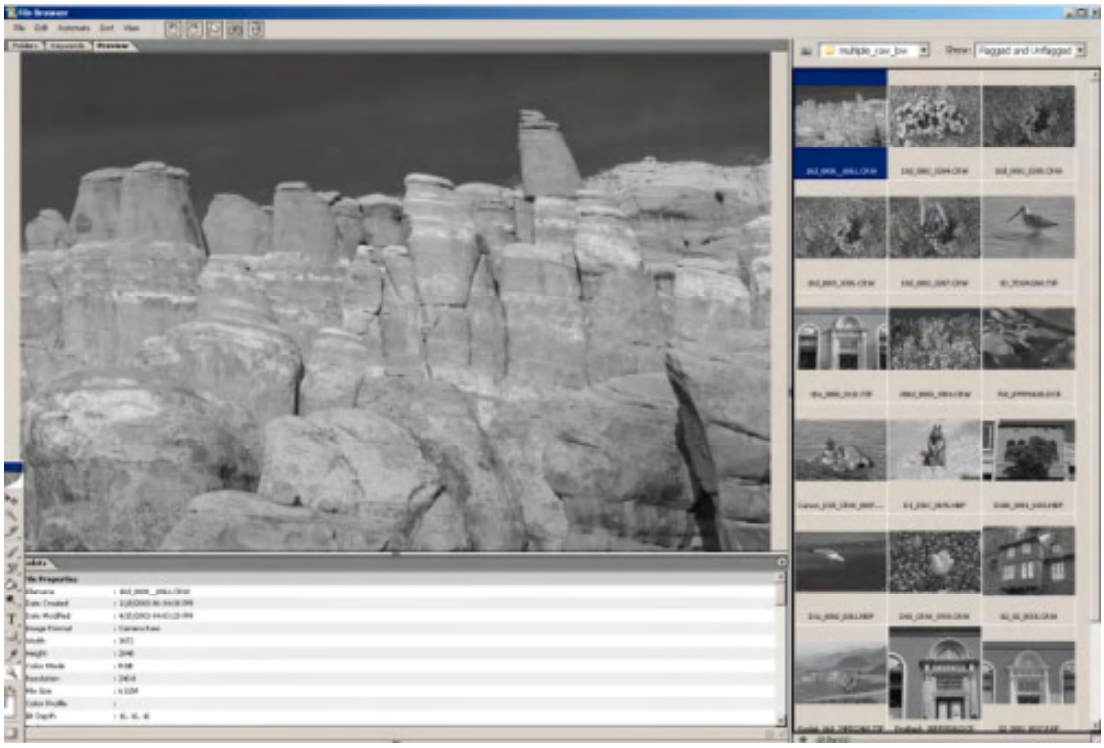
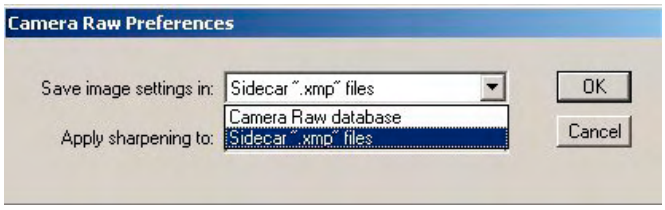


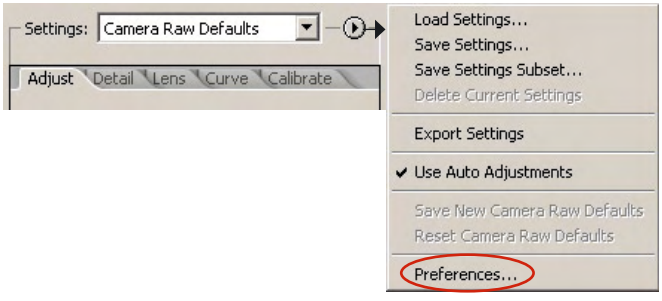
Figure 12-4: Full B & W view

Note: Use the option "Sidecar xmp files." Otherwise, any other color images with the same name might turn gray, too.



◂ *Figure 12-5: Set your preferences for your image settings.*

For this setup of ACR, use (while Extended is activated) the triangle pull down menu Settings ▸ Preferences.



◂ *Figure 12-6: You may save your ACR settings as new camera defaults.*

B&W with Capture One DSLR

We recall that Capture One DSLR (Capture One) allows displaying images in grayscale, by activating the button (top right). This is acceptable, but not real exciting.

Figure 12-7: Capture One in grayscale display mode (click for this)

Capture One can also convert to grayscale on output.

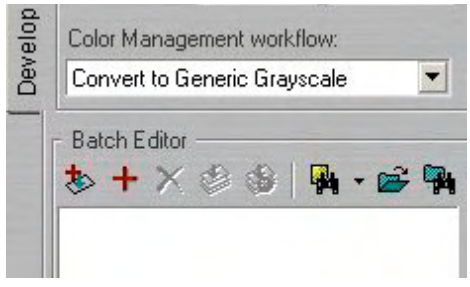


Figure 12-8: Capture One provides a generic grayscale profile.

This creates a grayscale image with a gamma of 2.2. However, we like to view a B&W image in RGB mode instead. An RGB image allows further optimization within Photoshop.

The solution is to create a new profile converting to B&W. This can be done with the profile editor of Capture One DSLR Pro by desaturating colors. Unfortunately, Capture One only allows desaturating by 30% in a single step. We needed to repeat this process a couple of times to come up with a first B&W profile which we share with our readers (see [6]).

At this point, we are close to our goal of a 100% B&W workflow:

1. Select the new B&W profile as default for your camera

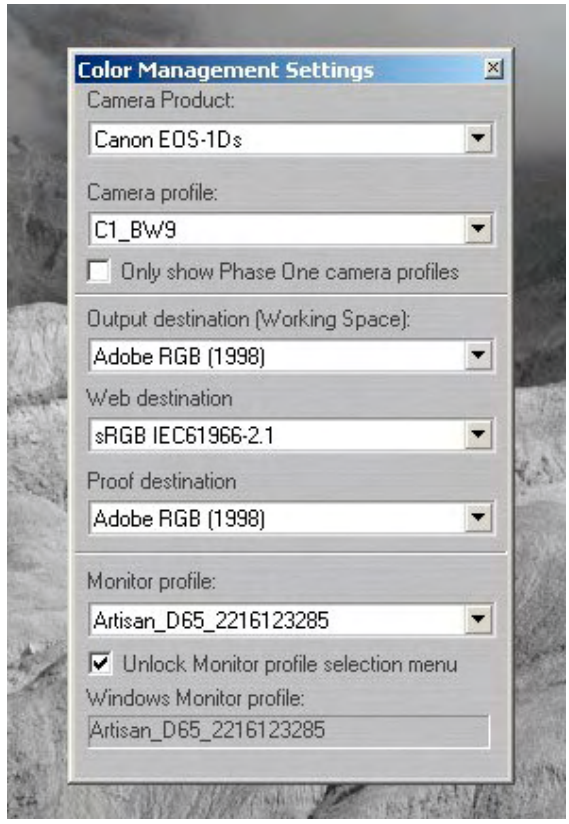


Figure 12-9: You may select a B&W profile as the default profile for your camera in Capture One DSLR.

This has an amazing side effect … thumbnails display in B&W.

2. The Exposure, Contrast, Levels and Curves tools in Capture One are very good in controlling B&W contrast and brightness.

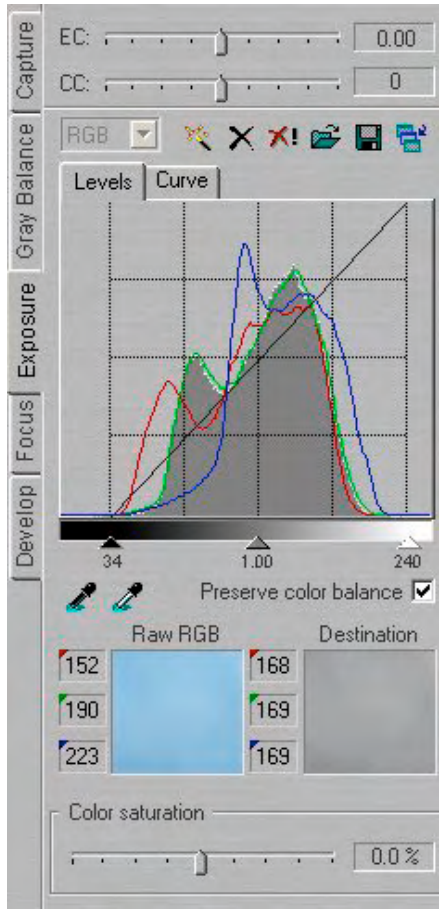


Figure 12-10:
Use the Capture One tools Exposure, Contrast and Curve to adjust your B&W image to your aesthetic liking.

3. The techniques in Photoshop (Channel Mixer) allow you to filter the color image to get a better B&W rendering. Here we can (mis)use the WB control in Capture One.

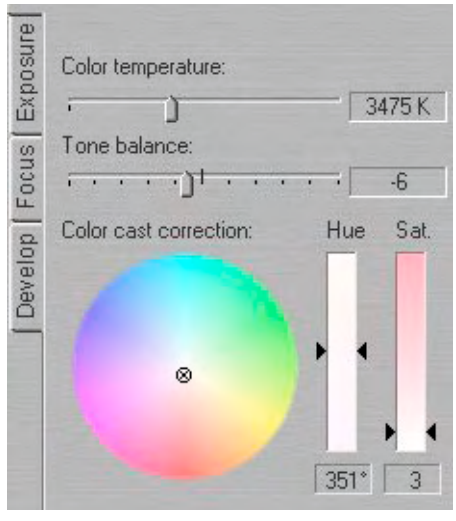


Figure 12-11:
You may use the B&W control of Capture One to control the look of the B&W image (which is still a color image.)

All three controls (Temperature, Tone Balance and especially Color Cast) have an influence on the B&W conversion (settings may also be saved).

In addition, Color Saturation can be used to alter B&W rendering. You can even try messing with the single RGB channels in Levels (Unfortunately, Curves in Capture One doesn't allow this yet).

Figure 12-12: 300D photo converted in Capture One

Working in color and Black&White

If you choose to work in B&W and color, use of Capture One allows you to have only one type of settings and previews in your cache.

We installed Capture One a second time in a different folder to ensure that the cache is not shared (by default). You needn't go through a licensing hassle by copying the *.lic file from the old installation root to the new installation root.

Sample

We want the B&W photo to not be overly contrasty in Capture One. Later we will open the file in Photoshop and apply some initial mild

sharpening (applied as a layer ([10]) – it allows us to improve the sharpening later on).

Next, in Photoshop tweak the black and (if necessary) the white point in an Adjustment Layer to get the final B&W snap. By doing this, we can tweak the brightness and contrast later.

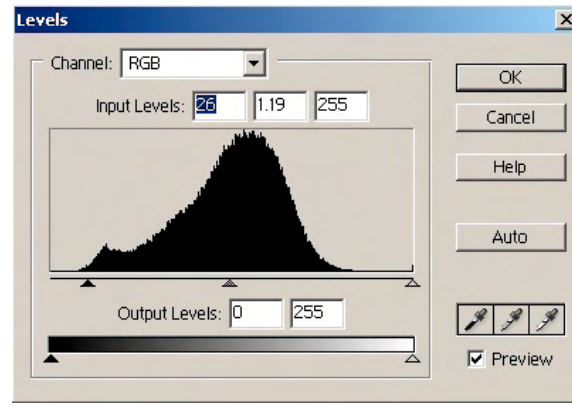


Figure 12-13: Use a Levels adjustment layer to tweak the white point of your image.

Figure 12-14: 300D converted with Capture One

Finally, the image gets saved as a PSD file. ImagePrint 5.6 (see [11]) will open PSD files and print using a custom ImagePrint gray profile.

B & W with Raw Shooter

B & W also works well using RawShooter. With it you can use both techniques from ACR (setting saturation to zero) or Capture One (using a B & W profile). Most often, setting saturation to zero seems to be most convenient. You can even have different color and B & W Snapshot settings in RawShooter.

Especially the Fill Light, Shadow contrast and Highlight contrast sliders aid in optimizing the tonality of your B & W pictures. Hard contrast, sometimes very disturbing in color photos, looks fine in B & W. We frequently use stronger positive settings for Shadow and Highlight contrast.

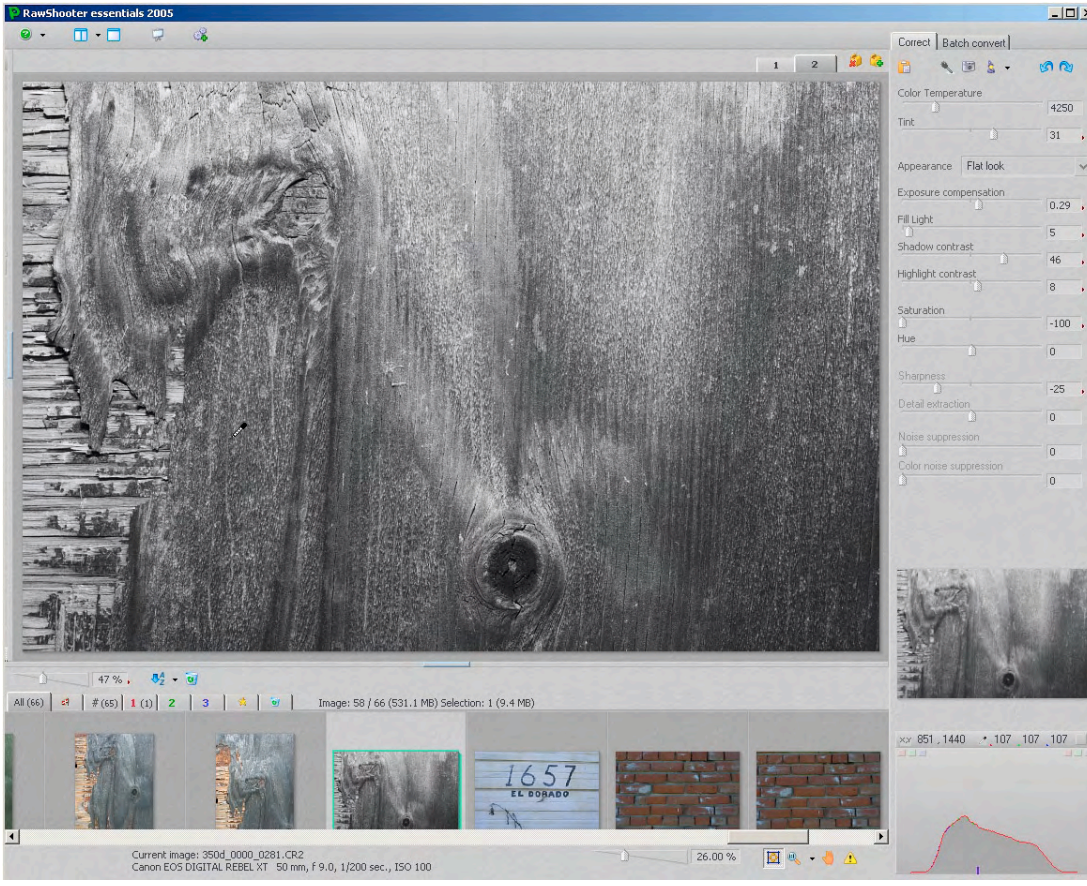


Figure 12-15: B & W in RawShooter

Glossary/Abbreviations

AA filter • ***A**nti-**A**liasing Filter* used in digital cameras to spread incoming light slightly so that small points of white light will be recorded by more than one sensor element.

aberration • With digital photographs, there are two types of aberrations:
(1) ***chromatic aberrations***. These are caused by the fact that a lens refracts light differentially as a function of its wavelength (color). Good lenses compensate largely in that by combining several lens elements. Such a lens is called an 'achromatic lens'. Chromatic aberrations (CA for short) usually show up as purple/green fringes that are more visible at the edges of an image. Good RAW converters offer a tool to reduce chromatic aberrations.
(2) ***spherical aberrations***. Results in some blur in an image.

absolute colorimetric • See *rendering intent*.

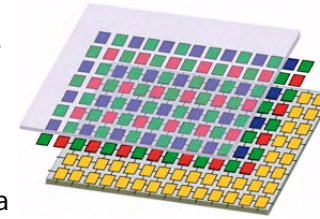
ACR • see *Adobe Camera Raw*.

Adobe RGB (1998) • A color space defined by Adobe. It is well-suited for digital photographs and has a reasonably wide gamut, larger than sRGB, and includes most printable colors.

Adobe Camera Raw (ACR) • This is the RAW converter provided as a plug-in by Adobe as part of Photoshop CS1 and CS2. Photoshop CS1 (aka Photoshop 8) ships with ACR 2.x while Photoshop CS2 (aka Photoshop 9) has ACR 3.x. Photoshop Elements 3 provides a slightly stripped ACR 2.x interface.

artefacts (or artifacts) • An undesirable effect visible when an image is printed or displayed, such as moiré patterns, banding or compression artefacts. Compression artefacts (JPEG artefacts) may result from too severe JPEG compression. Also over-sharpening may produce artefacts.

banding • Noticeable tonal level jumps in an area, where a continuous tone level would normally be. Banding is one type of *artefact*.

Bayer pattern • 
An array of color filters placed in front of camera sensors that allow the camera to capture color information although those sensor elements can only record brightness. The Bayern pattern, in most cases, consists of a matrix of tiny green, red and blue filter elements. The Bayer pattern algorithm (there are several others) interpolates from individual gray levels RGB colors for each pixel of an image.

blooming • An effect occuring when a CCD cell of a camera sensor receives too much light. Its electronic charge transfers to the next cell thus producing an undesired 'blooming' effect. Blooming is most visible at the edges of high contrast and highly saturated colors.

black point • The density (or color) of the darkest black a device may reproduce.

Black levels beyond that are clipped to the black point.

C1 • Capture One DSLR by Phase One ([36]). As there is a trademark issue with C1, Phase One no longer uses this abbreviation, but instead uses "CO".

CA • ***C**hromatic **A**berration*. See *aberration*.

calibration • Adjusting the behavior of a device to a pre-defined state. Calibration, in many cases, is the first step when *profiling* a device.

camera RAW format • See *RAW*.

candela • Unit of measurement for luminosity. Luminosity is specified in candela per square meter (cd/m²).

CCD • ***C**harged **C**oupled **D**evice*, an electronic element that accumulates an electronic charge depending upon the amount of light (photons) perceived by the element. The photographic sensors of most present-day digital cameras consists of a matrix of CCDs. An alternative technique used as camera sensors are CMOS-based sensors.

cd • See *candela*.

CF • ***C**ompact **F**lash* – a type of data storage used in memory cards for digital cameras.

CIE • ***C**ommission **I**nternationale de l'**E**clairage*. This is the international scientific organization which defined the CIE Lab standard.

CIE LAB • See *Lab*.

characterization • See *profiling*.

CMM • ***C**olor **M**atching **M**odule* – the internal color engine of a color management system. It does the color translation from different (source) color spaces to the PCS (***P**rofile **C**onnection **S**pace*), and from the PCS to the output color space. Well known CMMs are Apple's *ColorSync* for the Mac and Microsoft's ICM as an integral part of Windows. Adobe provides its own CMM module with applications, such as Photoshop and InDesign. It's called ACE (***A**dobe **C**olor **E**ngine*).

CMS • ***C**olor **M**anagement **S**ystem*.

CMYK • A color model based on the four primary printing colors *cyan*, *magenta*, *yellow* and *black* (Black is also called the *key color*). Used in print production, they form a subtractive color model. Though many inkjet printers use CMYK inks (and often other additional colors), they, in fact, present an RGB interface to the user.

CRT • Cathode Ray Tube – a component in monitors utilizing glass tubes for display.

clipping • The loss of certain tonal values usually found in the color or tonal limits of a color space. Clipping occurs, for example, when converting images from 16-bit-mode to 8-bit or when converting from RGB to CMYK. In these cases, usually some saturated colors are clipped to become less saturated colors.

color gamut • See *gamut*.

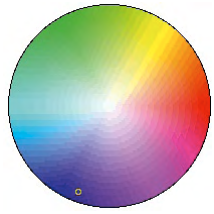
colorimeter • An instrument used to measure the color of emitted light. Often one is used in profiling monitors.

color model • The way colors are described by numbers. RGB, for example, uses a triple, denoting the amount of red, green and blue. CMYK uses a quadruple for the percentage of cyan, magenta, yellow and black. There exist other colors models, such as Lab, HSM, Grayscale (a gray value) or Bitmap (with pixel values of 0 or 1 – white or black respectively).

color space • A range of colors available for a particular profile or color model. When an image resides in a particular color space, this limits the range of colors available to that image. It also defines *how* the color values of an image are to be interpreted. There are *device-dependant color spaces* (e. g. that of a scanner or printer) and *device-independent color spaces* (e. g. Lab, Adobe RGB (1998) or sRGB).

ColorSync • Apple's implementation of ICC-based color management (part of Mac OS 9 as well as Mac OS X).

color wheel • A circular diagram displaying the available color spectrum (at a particular brightness level).

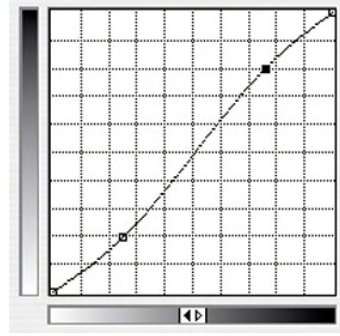


color temperature • A measure on the spectrum of the wavelength of white (light). The unit used is Kelvin (K). Lower color temperatures correspond to a red or yellowish light, higher temperatures result in a bluish tint. The term 'temperature' stems from a 'blackbody radiator' emitting (white) light when heated to a specific color temperature Here are some examples:

candle light, fire	1 000–1 800 K
tungsten	2 600–2 700 K
halogen lamp	3 400 K
moonlight	4 100 K
D50 daylight illuminant	5 000 K
sunny and blue sky	5 800 K
D65 daylight illuminant	6 500 K
flash	6 500 K
cloudy sky	7 000–8 000 K
neon light	8 000–9 000 K
sunny mountain snow	up to 16 000 K

chroma • The technical term for *saturation*.

curves • A tool in Photoshop that allows control (change) of tonal values in an image. The curve diagram below represents the relationship between input and output. By modifying this curve, corresponding tonal values of the pixels in the image are changed.



CS1, CS2 • Adobe Creative Suite 1 & 2. The full suite includes Photoshop, InDesign, Illustrator, GoLive and Version Cue. The Premium suite includes Acrobat. CS2 also includes Bridge.

D50 • Daylight at 5 000 Kelvin. This is the standard light (*illuminant*) in the printing industry (prepress) for evaluating colored prints.

D65 • Daylight at 6 500 Kelvin. This is the standard (*illuminant*) that is closer to the light emitted by CRT or LCD monitors.

device profile • See *ICC profile*.

dithering • A technique used to simulate many different colors and/or halftones yet utilizing only a few primary colors by placing dots in a certain pattern. Viewed from an appropriate distance, the image is perceived as a continuous tone image.

dot gain • Halftone dots grow slightly in size when printed (e. g. due to ink spread-

ing). This is called *dot gain*. Coated paper has a dot gain of 8–20 %, while with uncoated paper it may grow up to 28 %. Photoshop may take dot gain into account when producing output for printers by reducing a dot size appropriately to compensate for its future dot gain.

dpi, DPI • ***d**ots **p**er **i**nch*. Used as a measurement of print resolution in regard to ink or toner dots per inch on paper or printing plates. Most printing techniques (e. g. inkjet printers or offset presses) simulate a halftone value or a non-primary color of a pixel using a pattern of tiny dots. With such printing techniques, the dpi value of a printing device must be considerably higher (by a factor of 4 to 8) than the *ppi* (*pixel per inch*) value of the image.

DSLR • ***D**igital **S**ingle-**L**ens **R**eflex* – a standard type of professional and semi-professional digital camera.

ECI • ***E**uropean **C**olor **I**nitiative*. This organization focuses on defining standardized means to exchange colors (color images) on the basis of ICC profiles. You may find some specific color profiles at their Internet home page (see www.eci.org).

ECI-RGB • An RGB work space for those images destined for prepress work in Europe. Its gamut is somewhat wider (slightly more green tints) than that of Adobe RGB (1998) and also covers nearly all colors intended to be printed.

EPS • ***E**ncapsulated **P**ost**S**cript*. A standard file format for graphics, usually those including vector graphics or a mix of vector graphics and bitmap images. Often, EPS files contain both the actual graphic information and additionally a preview image of that graphic.

EV • ***E**xposure **V**alue*.

Exif, EXIF • A standardized format for camera metadata (e. g. camera model, exposure value, focal length, …). This data is usually embedded in the image file and may be used for searching, as well as, by applications to act in an intelligent way on the data. PTLens, one example, uses the focal length value from EXIF data to correct lens distortions.

Firewire • (IEEE 1394) a fast, serial interface for cardreaders, digital cameras, scanners and other peripheral devices. Firewire allows for transfer rates of up to 40 MByte/s (1394a) or 80 MByte/s (1394b).

gamma • (1) Relationship between tonal values (or input voltage with a monitor) and perceived brightness. There are two gamma values in broad use:
(A) 1.8, the Apple standard for the Mac and preferred in prepress work.
(B) 2.2, the Windows standard. For photographs, we recommend using 2.2, (even on Macintosh systems) when it comes to monitor calibration and profiling.
(2) The degree to which a *color space* or device is non-linear in tonal behavior.

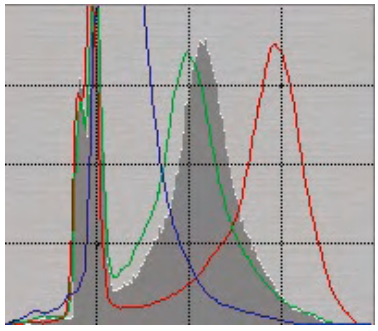
gamut • The total range of colors (and densities) a device can reproduce (e. g. a monitor or printer) or capture (e. g. a scanner or digital camera). *Color gamut* is the range of colors a device can reproduce (or capture) and *dynamic range* refers to the brightness levels a device can produce or capture.

gamut mapping • The way colors are remapped when an image is converted from one color space to another. If the destination space is smaller than the source space, color compression or color *clipping* will be take place.

gray balanced • A color space is called *gray balanced* if equal values of the *primary colors* result in a neutral gray value. This situation is preferable for work spaces.

highlights • Areas of an image with no color or gray level at all.

histogram • A visual representation of tonal levels in an image. With color images, it is advantageous not only to see luminance levels but also tonal levels of each individual color channel:



HSB, HSL • Adaptions of the RGB color model. Colors are described by a ***h**ue*, ***s**aturation* of the hue and ***l**ightness* (HSL) or ***b**rightness* (HSB).

hue • Hue is normally referred to as *color tint*.

ICC • ***I**nternational **C**olor **C**onsortium*. A consortium of companies that develop industry-wide standards for color management – e. g. ICC profiles. For more information see www.color.org.

ICC profile • A standardized data format to describe the color behavior of a specific device. ICC profiles are the basis of color management systems. They allows CM systems to maintain consistent color impression across different devices, different platforms and throughout a complete color-managed workflow.

ICM • ***I**mage **C**olor **M**anagement* or ***I**ntegrated **C**olor **M**anagement* – the Microsoft implementation of the color management module in Windows.

intent • See *rendering intent*.

IT-8 • A family of standard targets used by profiling devices such as scanners or digital cameras.

IPTC • ***I**nternational **P**ress **T**elecommunication **C**ouncil*. In photography, IPTC is a metadata format describing the image. It provides fields, e. g. for copyright notices, rights usage terms, a title (caption) and keywords.

JPEG • ***J**oint **P**hotographic **E**xperts **G**roup*. This ISO group defines a file format standard for color images. The JPEG format uses lossy compression, offering various tradeoffs between high quality (at lower compression) and lower quality resulting in a higher compression but smaller files.

Lab, LAB, L*a*b*, CIE LAB • A perceptual-based color model defined by the *CIE*. Colors in this model are defined by L (***L**uminance*) and two color components, **a** and **b**. 'a' (or 'A') is the axis ranging from red to green while 'b' (or 'B') ranges from blue to yellow.

LCD • ***L**iquid Crystal **D**isplay*. A display technique used with flat panel monitors (TFT monitors).

lpi, LPI • ***L**ines **p**er **I**nch*. The measure used to define printing resolution (or screen frequency) with typical halftone printing methods, such as, offset printing.

luminance • Amount of light (energy) emitted by a light source, e. g. by a monitor. The unit used with monitors is *candela per square meter* (cd/m²).

metadata • Data describing other data objects. EXIF and ITPC data are examples of metadata as part of digital photographs.

PCS • ***P**rofile **C**onnection **S**pace*. This is an intermediate color space used when converting colors from a source space to a destination space (say, from one profile to another). According to the ICC specification it can be either *CIE-Lab* or *CIE XYZ*.

perceptual intent • See *intent*.

PNG • ***P**ortable **N**etwork **G**raphics*. A flexible image file format, providing indexed color for up to 8-bits per channel and also allowing transparency. This format, however, is not as flexible as TIFF.

ppi, PPI • ***p**ixel **p**er **i**nch*, used to specify the resolution of a digital image. See also *dpi*.

primary colors • Those colors of a color model used to construct the colors of the pixels. For RGB the primary colors are red, green and blue. CMYK primaries are cyan, magenta, yellow and black.

profile • See *ICC profile*.

profiling • The act of creating a device *profile*. Usually a two-step process, whereby the first step is to linearize the device. The second step measures the color behavior of the device and describes it with an ICC profile. The entire process is also called ***characterization***.

PS • ***P**hotoshop*.

RAW (camera RAW format) • See *ICC profile*.

Relative colorimetric • See *rendering intent*.

rendering intent • A strategy to achieve color space mapping when converting colors from a source to a destination color space. ICC has defined four different standard intents:
(1) ***Perceptual*** compresses colors of the source space to the gamut of the destination space (where the source space is smaller than the destination space). This is the intent recommended for photographs.
(2) ***Relative colorimetric*** does a 1:1 mapping when the colors in the source space are all present in the destination space. Out-of-gamut colors of the source are mapped (clipped) to the nearest neighbor of the destination space. This intent may be used for photographs if most of the colors in the source space are available in the destination space. In this case, most colors of the source are mapped 1:1 into the destination. The *white point* of the source space also is mapped to the *white point* of the destination space.
(3) ***Absolute colorimetric*** does a 1:1 mapping when colors in the source space are present in the destination space. Out-of-gamut colors of the source are mapped (clipped) to the nearest neighbor of the destination space. The *white point* of the source is maintained. This intent is used (only) for *soft proofing*.
(4) ***Saturation***. This intent aims to maintain saturation of a source color, even when the actual color has shifted during the mapping. This intent may be used when mapping logos and diagrams, but is not suitable for photographs.

resolution • This term defines the depth of detail that an image can reproduce. Resolution is measured in dots per inch (*dpi*) or pixels per inch (*ppi*).

RGB • ***R**ed, **G**reen, **B**lue*. These are the primary colors of the standard additive color model. Keep your photographs in RGB!

mode as long as possible and use RGB for archiving your images.

RIP • ***R**aster **I**mage **P**rocessor*. A module, either part of a printer or a software application. The RIP converts page information into a raster image or dot pattern for printing.

RS, RSE • RawShooter Essential – a free good RAW converter by Pixmatec ([35]).

saturation • (1) defines the purity of color. Saturation may vary from none (which is gray) via pastel colors (some saturation) to pure colors (full saturation) with no gray. (2) One of the four rendering intents. See *rendering intents*.

spectrophotometer • An instrument to measure the color of emitted and reflected light. It usually is used for profiling printers and measuring the color (light spectrum) of a print or other surface.

soft proof • Usage of the monitor as a proofing device. For soft proofing Photoshop simulates the colors a picture will have on a different output method (e. g. a print) on the monitor.

sRGB • A standard color space for monitors. It is intended for images presented on monitors or in the Internet.

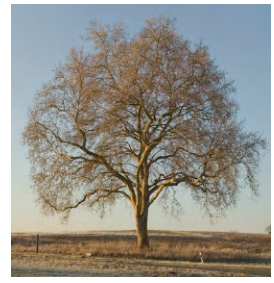
tagged images • Images with embedded color profile.

TIFF • ***T**agged **I**mage **F**ile **F**ormat*. A file format for images. TIFF acts as an envelope format for a lot of different image formats and allows several different compression modes – most of them lossless (e. g. LZW, ZIP, Runlength encoding, uncompressed). It allows to store different color depths (from 1 to 32 bit per channel), embed comments, profiles, and other metadata as well as layers and alpha channels. It is well suited as an archival format for images.

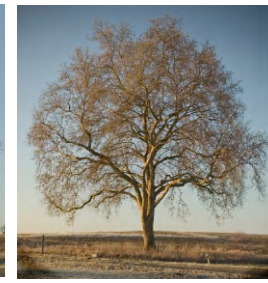
USB • Universal Serial Bus. A computer device interface for peripherals such as card readers, cameras, scanner or external disks. There are two version of the USB bus, where USB 2 (high speed) is much faster (up to 60 MByte/s)than USB 1.x (up to 1.2 MByte/s).

USM • ***U**nsharp **M**asking*. A method of sharpening an image by increasing the contrast of edge pixels. The term stems from a traditional film-composing technique.

vignetting • Vignetting is an effect where some areas of a photograph are less illuminated that others. Most camera lenses exhibit "optical vignetting" to some degree – mostly at the outer edges but stronger when an aperture is wide open. "Mechanical vignetting" may occur, if a lens hood is too small or not properly attached.



slight vignetting



very strong vignetting

wide gamut RGB • A large color space that covers almost all of RGB. There is no physical device that can reproduce all color of *wide gamut*. This color space is sometimes used for archival purposes, if output shall be produced for photographic printers or transparent recorders.

white balance • Adjusting the color temperature and color tints in an image, so that

there is no color cast and gray areas show no color tint.

white point • (1) The color of 'pure white' in an image. On a monitor, it is the brightest white the monitor can display. In photo prints, it usually is defined as the color of the blank paper.
(2) The color of a light source or lighting conditions in terms of *color temperature*.
(3) The color "white" in a color space. For example *Adobe RGB (1998)* and *sRGB* have a white point of 6 500 K (*D65*) while *ECI-RGB, Color Match RGB* and *Wide Gamut RGB* have a white point of 5 000 K (*D50*). Most CMYK color spaces have a white point of D50.

white point adaption • When a color mapping has to take place and the source and the destination spaces have different *white points*, with some *intents* (e. g. *Relative colorimetric*) colors are adapted relative to the new *white point*.

working space • A device-independent color space (profile). It defines the color *gamut* available to the image using this working space. For photographers *Adobe RGB (1998)* or *ECI-RGB* (in Europe) are the working spaces recommended.

Resources

Camera: Nikon D100

Remember that Internet addresses may change or vanish over time. We attempt, however, to keep up to date. In the e-book version you can click on the links (in blue) to get to a particular page directly with your browser.

B.1 Recommended Books

[1] Tim Grey: *Color Confidence. The digital photographer's guide to color management. Sybex Inc, San Francisco, 2004.*

[2] Bruce Fraser, Chris Murphy, Fred Buntig: *Color Management. Industry-strength production techniques. Peachpit Press, Berkeley, CA, 2003.*

[3] Ben Willmore: *uptospeed – Photoshop CS2.* Peachpit Presss, Berkeley, 2005.

B.2 Useful resources in the Internet

[4] *Outback Photo*: The home-page of Bettina & Uwe Steinmueller with lots of information on digital photography: www.outbackphoto.com

[5] *Colors by Nature* – some of the color works of Bettina & Uwe Steinmueller: www.colors-by-nature.com

[6] Uwe Steinmueller: *A Profile for B&W conversion*: www.outbackphoto.com/artofraw/raw_08/profile_BW.zip

[7] Digital Outback Photo: *Our Tonality Tuning Toolkit*: www.outbackphoto.com/workflow/wf_61/essay.html

[8] Digital Outback Photo: Paper on sharpening: http://www.outbackphoto.com/dp_essentials/dp_essentials_05/essay.html

[9] Digital Outback Photo: Paper on noise reduction: www.outbackphoto.com/dp_essentials/dp_essentials_04/essay.html

[10] Digital Outback Photo: An essay on *Workflow techniques using actions and filters in layers*: www.outbackphoto.com/workflow/wf_19/essay.html

[11] Digital Outback Photo: An essay on printing insights: www.outbackphoto.com/printinginsights/pi.html

[12] Paper on *Noise Ninja* – a noise removal tool (,): www.outbackphoto.com/workflow/wf_25/essay.html

[13] ICC – International Color Consortium: www.color.org

[14] ECI – European Color Initiative www.eci.org

[15] GretagMacbeth: *ColorChecker* and several profile packages (e. g. Eye-One Match and Eye-One Photo): www.gretagmacbeth.com

[16] ColorVision: Color Management Tools (e.g. ColorPlus, Spyer2Pro, ProfilerPlus, PrintFIX, …): www.colorvision.com

[17] Monaco Systems (now part of X.rite): Color Management Tools (Profiling packages, e.g. Monaco OPTIX for monitor profiling): www.xritephoto.com

[18] Digital Domain Inc.: *Profile Prism*. ICC profiling tool for cameras and scanners: www.ddisoftware.com/prism/

[19] Pixmantec: *RawShooter Essentials* ( ). A RAW converter for a broad range of DSLRs: www.pixmantec.com

[20] Phase One: *Capture One DSLR* (,). A RAW converter for a broad range of DSLRs. www.phaseone.com

[21] Bibble Labs: *Bibble*. (,). A RAW converter for a broad range of DSLRs. www.bibblelabs.com

[22] Canon: *Canon Digital Photo Professional*. (,). A RAW converter for various Canon DSLRs: www.canon-europe.com/Support/Patches/dpp/

[23] Nikon: *Nikon Capture*. (,) A RAW converter for most of Nikon's DSLRs: http://nikonimaging.com/global/products/software/capture4/

[24] PictoColor: *inCamera*. ICC profile software for digital cameras and scanners: www.picto.com

[25] *PTLens* – A correction program for lens flaws (Photoshop Plug-in for Windows): http://epaperpress.com/ptlens

[26] *LensFix & PanoTools* – Lens distortion correction & image remapping plug-ins for Mac OS: www.kekus.com

[27] *NeatImage*. Noise removal tool (,): www.neatimage.com

[28] *Noiseware*. Noise removal tool (,): www.imagenomic.com

[29] *Helicon Filter Pro*. A freeware set of filters to remove red eye, reduce noise, to do sharpening and color tuning ( ): www.shareup.com/Helicon_Filter_pro_download-21227.html

[30] *Debarrelizer*. For corrections of barrel distortions (,): www.theimagingfactory.com/data/pages/products/products1.htm

[31] *Focus Magic*. A sharpening tool ( ): www.focusmagic.com

[32] *Focus Fixer*. A sharpening tool (,): www.fixerlabs.com

[33] Digital Domain Inc: *Qimage RIP* ( ) and *Profile Prism* ( ) – a profiling software for printers, digital cameras and scanners: www.ddisoftware.com

[34] *DxO Optics Pro*. Corrects distortions and lateral chromatic aberrations and vignetting (,): www.dxo.com

[35] *Exifer for Windows*. Management of EXIF/ITPC meatadata. ( ): www.friedemann-schmidt.com/software/exifer/

[36] ACD Systems: *ACDSee*. Photo Management Software ( ): www.acdsystems.com

[37] Cerious Software: *ThumbsPlus Pro*. Simple to use digital asset management system ( ): www.cerious.com

[38] *Rname-it* ( ). A free flexible Windows renaming utility: www.outbackphoto.com/handbook/cameratocomputer.html

[39] *Renamer4Mac* (): A free renaming utility for Mac OS X:
http://mac.softpedia.com/get/Utilities/Renamer4Mac.shtml

[40] Helmut Dersch: *Panorama-Tools*. ( ) Tool for digital panoramas, used as the basis for PTLens.
www.ptgui.com

[41] *Donwloader Pro*. ( ). A windows utility to download and rename image files from a memory card or from a camera:
www.outbackphoto.com/computers_and_more/veit_downloader_pro/essay.html

[42] *Photorescue* ( ).
A utility for Windows and Mac to extract image files from a corrupted memory card:
http://www.outbackphoto.com/handbook/usingdslr.html#photorescue

[43] Adobe: Paper on XMP customizing:
www.adobe.com/products/xmp/custompanel.html

[44] New versions of Adobe Camera Raw
www.adobe.com/support/downloads/

[45] Free Adobe DNG converter
www.adobe.com/products/dng/

[46] EasyS Sharpening Toolkit:
www.outbackphoto.com/workflow/wf_66/essay.html

[47] Bettina&Uwe Steinmueller: *Digital photography workflow handbook*:
www.outbackphoto.com/booklets/dop2000/DOP2000.html

[48] Dr. Brown Russell: *Tips & Techniques for Photoshop CS2*.
Dr. Brown's Services 1.0 make this whole process much more easy (check out the movie):
www.russellbrown.com/tips_tech.html

[49] Jack Flesher: *Paper Upsizing in Photoshop*:
www.outbackphoto.com/workflow/wf_60/essay.html

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